

Frank Sauer – Research Misconduct Investigation Report*

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* This report is organized as defined in the *University of California Riverside Policy and Procedures for Responding to Allegations of Research Misconduct, Riverside Policy Number 529-900, Section VII.E1.*

Summary of Allegations and Investigation Committee Conclusions

The Committee investigated and made findings on a total of 33 allegations of research misconduct by Dr. Frank Sauer. The initial Allegations of research misconduct were anonymously submitted via email to Dallas L. Rabenstein, Executive Vice Chancellor and Provost of UC Riverside, on October 3, 2011 (**Appendix 1**). This e-mail grouped the allegations into six sets of allegations, I through VI, for a total of 26 initial allegations. *Science* magazine subsequently submitted five additional allegations (**Appendix 7**). Finally, in the course of the investigation, the Investigation Committee identified two additional instances of possible research misconduct.

The Inquiry Committee separated the allegations into twelve (12) separate groups (**Appendix 10**). Subsequently, the Investigation Committee assigned a specific "Allegation Number" to each allegation in these twelve separate groups; a 13th allegation was added by the Committee as a result of information derived from the interviews with witnesses. As stated, this resulted in a total of thirty three (33) separate allegations of research misconduct.

Table 1 identifies the source of each allegation; Table 2 summarizes the decisions of the Inquiry and Investigation Committees regarding each of these allegations; Table 3 provides a summary of the nature of each allegation for which there was a finding of research misconduct.

Table 1: Source of the Allegations

Allegation Number	Allegations from 10/3/11 Anonymous e-mail Identifier	Allegations from Science 11-18-11 (Appendix 7)	Allegations Added by Committee
1	I.1		
2	I.2		
3	II		
4.1	III.1		
4.2	III.1		
5.1	III.2		
5.2	III.2		
5.3	III.2		
5.4		X	
5.5		X	
5.6		X	
5.7		X	
5.8	III.2		
5.9		X	
6.1	III.3		
*6.2	III.3		
7	IV.1		
8.1	IV.2		
8.2			X
8.3	IV.2		
8.4	IV.2		
8.5	IV.2		
8.6	IV.2		
9	V.1		
10.1	V.2		
10.2	V.2		
10.3	V.2		
10.4	V.2		
10.5	V.2		
*10.6	V.2		
11	VI.1		
12	VI.2		
*13			X

* Contains multiple allegations

In Table 2, the 33 allegations are further divided into the 20 allegations that the Committee determined were research misconduct and the 13 allegations the Committee dismissed in the Inquiry or Investigation because of the absence of any of the original data (these allegations relate to publications in the 1990s), or the identification of data that appeared to be the original experiment and dismissal was appropriate.

Table 2: Summary of Committee Decisions

Allegation Number	Allegations Where Investigation Committee made Misconduct Finding	Allegations Dismissed In Inquiry	Allegations Dismissed In Investigation
1		X	
2		X	
3			X
4.1	X		
4.2	X		
5.1			X
5.2			X
5.3			X
5.4	X		
5.5			X
5.6	X		
5.7	X		
5.8			X
5.9	X		
6.1	X		
*6.2	X		
7	X		
8.1	X		
8.2	X		
8.3	X		
8.4	X		
8.5		X	
8.6		X	
9	X		
10.1	X		
10.2	X		
10.3	X		
10.4		X	
10.5	X		
*10.6		X	X
11		X	
12	X		
*13	X		

* Contains multiple allegations

Table 3 provides a summary of the nature of each allegation for which there was a finding of research misconduct.

Table 3: Categorization of Research Misconduct Findings

Allegation Number	Research Misconduct Type	Specific Finding
4.1	Falsification & Fabrication	Same image used for different figures
4.2	Falsification & Fabrication	Same image used for different figures
5.4	Falsification & Fabrication	Gel with spliced in bands and no disclosure of splicing
5.6	Falsification	Gel with spliced in band and no disclosure of splicing
5.7	Falsification	Gel with spliced in band and no disclosure of splicing
5.9	Falsification & Fabrication	Gel with spliced in bands and no disclosure of splicing
6.1	Falsification & Fabrication	Gel with spliced in bands and no disclosure of splicing
6.2	Falsification & Fabrication	Gel with spliced in bands and no disclosure of splicing
7	Fabrication & Falsification	Same as Allegation 4.1 & 4.2
8.1	Falsification & Fabrication	Gel with spliced in bands and no disclosure of splicing
8.2	Falsification & Fabrication	Gel with spliced in gel lane and no disclosure of splicing
8.3	Falsification & Fabrication	Same as Allegation 4.2
8.4	Fabrication	Gel with spliced in bands and no disclosure of splicing
9	Falsification	Falsified larva image
10.1	Falsification	Gel with spliced in gel lane and no disclosure splicing
10.2	Falsification	Gel image spliced, separately manipulated, & reassembled with no disclosure
10.3	Falsification	Gel image spliced, separately manipulated, & reassembled with no disclosure
10.5	Falsification & Fabrication	Gel with spliced in gel lanes with no disclosure of splicing
12	Falsification	Removed gel bands with no disclosure
13	Falsification & Fabrication	Same images used for different figures

The University of California, Riverside Policy Number 529-900, Section I.C, Policy and Procedures for Responding to Allegations of Research Misconduct states:

1. Definition. **Research Misconduct** means fabrication, falsification, or plagiarism, in proposing, performing, or reviewing research, or in reporting research results.
 - a. **Fabrication** is making up data or results and recording or reporting them.
 - b. **Falsification** is manipulating research materials, equipment, or processes, or changing or omitting data or results such that the research is not accurately represented in the research record.
 - c. **Plagiarism** is the appropriation of another person's ideas, processes, results, or words without giving appropriate credit.
 - d. Research Misconduct does not include honest error or differences of opinion.
2. Requirements for a Finding of Research Misconduct. A finding of Research Misconduct requires that:
 - a. There be a significant departure from accepted practices of the relevant research community;
 - b. The misconduct be committed intentionally, knowingly, or recklessly; and
 - c. The Allegation be proven by a preponderance of the evidence. "Preponderance of the evidence" means proof by information that, compared with that opposing it, leads to the conclusion that the fact at issue is more probably true than not.

Applying these standards and based on full consideration of the evidence, the Committee concluded that of the 21 allegations the Committee concluded were research misconduct, 3 were cases in which the same data had been used in different figures to represent different data, 11 were cases of gel bands or lanes spliced into a different background or figure, 2 were inappropriate image manipulation of an original experiment, one was a falsified larva image, one was a case of gel bands being removed from a figure, one was a case of failure to retain the research record, and 3 were duplicate allegations.

Based on the extensive interviews with witnesses and Dr. Sauer, analyses conducted by the journals and consultants, and analyses of the laboratory materials and digital files provided by Dr. Sauer, the Committee concluded that Dr. Sauer alone was responsible for these multiple instances of research misconduct in which he falsified and fabricated research data.

The Committee found that in numerous instances set out more specifically below, the evidence established a pattern of research misconduct and thereby met the applicable

evidentiary standards to show that at a minimum, such conduct was recklessness; and in some instances, the evidence demonstrated that the research misconduct was committed intentionally and knowingly. Further, the Committee found these instances of research misconduct were a significant departure from accepted practices of the research community.

The Investigation Committee has determined that Dr. Frank Sauer, Associate Professor of Biochemistry, alone was responsible for multiple instances of research misconduct in which he falsified and fabricated research data. The evidence established a pattern of research misconduct and met the applicable evidentiary standards to show that this conduct was, at a minimum, recklessness, and in some instances the research misconduct was committed intentionally and knowingly. These instances of research misconduct were a significant departure from accepted practices of Dr. Frank Sauer's research community. This report is submitted in accordance with University of California, Riverside Policy Number 529-900, Section VII.E, Policy and Procedures for Responding to Allegations of Research Misconduct.

(i) The name and title of the Committee members and experts

of Calforensics, 1013 Galleria Blvd., Suite 210, Roseville, CA 95678, was retained as a computer forensics expert on this matter.

Assisting the RIO, Vice Chancellor Charles F. Louis in this case:
Susan Fogel (SF), Senior Paralegal Specialist, Office of General Counsel of the Regents of the University of California, 1111 Franklin St., Oakland, CA 94607

(ii) The name and position of the Respondent:

Dr. Frank Sauer, Associate Professor of Biochemistry, University of California Riverside.

(iii) The Initial Allegations

The full list of initial Allegations submitted via email on October 31, 2011 is attached to this Report as **Appendix 1**.

The Allegations were anonymously submitted via email to Dallas L. Rabenstein, Executive Vice Chancellor and Provost of UC Riverside, on October 3, 2011. The Allegations were dated September 28, 2011 and reflects that they were also sent to the following individuals:

Mark G. Yudof, President of University of California;
Dallas L. Rabenstein, Executive Vice Chancellor and Provost of UC Riverside;
Craig V. Byus, Dean of Biomedical Science Division of UC Riverside;
Richard J. Debus, Chair of Biochemistry Department of UC Riverside;
Bernd Bukau, Director of the ZMBH;
Kevin P. Reilly, President of University of Wisconsin;
David Ward, Interim Chancellor of University of Wisconsin Madison;
Richard L. Moss, Dean of Basic Research of University of Wisconsin Madison;
Daniel S. Greenspan, Interim Chair of Cell and Regenerative Biology, Department of University of Wisconsin Madison;
Francis S. Collins, Director of National Institutes of Health (NIH);
Judith H. Greenberg, Acting Director of National Institute of General Medical Sciences (NIGMS);
Don Wright, Acting Director of NIH Office of Research Integrity (ORI);
John E. Dahlberg, Division of Investigative Oversight Director of NIH ORI;
Subra Suresh, Director of National Science Foundation (NSF);
VolkswagenStiftung Foundation;
Robert Tjian, Professor of Biochemistry and Molecular Biology of UC Berkeley;
Bruce Alberts, Editor-In-Chief of Science Magazine;
Monica M. Bradford, Executive Editor of Science Magazine;
Philip Campbell, Editor-In-Chief of Nature Journal;
Ritu Dhand, Chief Biological Sciences Editor of Nature Journal;
Lynn Herndon, President and CEO of Molecular Cell Journal; and
Emilie Marcus, Editor-In-Chief of Molecular Cell Journal

(a) The nature of the Allegations of Research Misconduct.

The allegations received October 3, 2011 were that eight papers published by Dr. Sauer over a period of sixteen (16) years contained figures that had been intentionally falsified (**Appendix 1**). The Inquiry Committee separated the allegations into twelve (12) separate groups (**Appendix 10**). Subsequently, the Investigation Committee assigned a specific "Allegation Number" to each allegation in these twelve separate groups; a 13th allegation was added by the Committee as a result of information derived from the interviews with witnesses. As stated, this resulted in a total of thirty three (33) separate allegations of research misconduct as follows.

Specific Allegations

Allegation #1

Data fabrications in **Paper 1** (Science. 1995 Dec 15;270(5243):1783-8) and **Paper 2** (Science. 1995 Dec 15;270(5243):1825-8).

The Western Blots in Fig. 2A of Paper 1 and Fig. 1B of Paper 2 are exactly the same. However, they were supposed to be obtained by two completely different experiments: the experiment of Fig. 2A in Paper 1 used Flag-BCD-Q and the one of Fig. 1B of Paper 2 used Flag-BCD to pull down the other proteins. According to Sauer et. al. BCD is the full length protein and BCD-Q is the truncated version.

Allegation #2.

Autoradiogram of Lanes 9-12 in Fig. 1D of **Paper 1** are the same as autoradiogram of Lanes 1-4 (in the reversed order) in Fig. 3h of a later retracted Cell **Paper 3** (Cell. 1996 Dec 27;87(7):1271-84). However, they are totally different experiments. Moreover, autoradiogram of Lanes 1-3 in Fig. 3h is the same as that of Lanes 2-4 in Fig. 3g of the retracted Cell **Paper 3**.

Allegation #3.

Data fabrication in **Paper 4** Science. 2000 Sep 29;289(5488):2357-60.

We highly suspect that protein bands in both panels of Fig. 4 were heavily manipulated. Due to our technical limitations, we do not know if these bands were pasted to the blot.

Allegation #4

III. Data fabrications in **Paper 5** Science 2004 May 14;304(5673):1010-4.

1. Coomassie Blue staining of H3, H2B, H2B and H4 bands of lanes 1 and 2 in Fig. 1B (**Paper 5**) are exactly the same of those of lanes 1 and 2 in Fig. 1b and those from lanes 2 and 3 in Fig. 2e from a different **Paper 6** (Nature. 2002 Oct 24;419(6909):857-62). These three experiments are completely different.

Allegation 4.1 The allegation that Fig 1b in **Paper 6** (Nature 2002) was duplicated to produce Fig 1b in **Paper 5** (Science 2004).

Allegation 4.2: The allegation that Fig 1b in **Paper 6** (Nature 2002) was duplicated to produce Fig 2e in **Paper 6**.

Allegation #5:

Paper 5 *Science* 2004 May 14;304(5673):1010-4. We highly suspect that protein bands in Figs. 1A, 1C, 1E, 3D were heavily manipulated. Due to our technical limitations, we do not know if these bands were pasted to the blot.

Allegation 5.1: **Paper 5** [*Science* 2004 May 14;304(5673):1010-4]. The allegation that the protein bands in Figs. 1A were heavily manipulated.

Allegation 5.2: **Paper 5** [*Science* 2004 May 14; 304 (5673):1010-4]. The allegation that the protein bands in Fig. 1C were heavily manipulated.

Allegation 5.3: **Paper 5** [*Science* 2004 May 14;304(5673):1010-4]. The allegation that the bands in Fig. 1E were heavily manipulated.

Allegation 5.4: **Paper 5** [*Science* 2004 May 14;304(5673):1010-4]. The allegation that the protein bands in Figs. 2C were heavily manipulated.

Allegation 5.5: **Paper 5** [*Science* 2004 May 14;304(5673):1010-4]. The allegation that the protein bands in Fig. 3A were falsified.

Allegation 5.6: **Paper 5** [*Science* 2004 May 14;304(5673):1010-4]. The allegation that the protein bands in Fig. 3B were falsified.

Allegation 5.7: **Paper 5** [*Science* 2004 May 14;304(5673):1010-4]. The allegation that the protein bands in Fig. 3C were falsified.

Allegation 5.8: **Paper 5** [*Science* 2004 May 14;304(5673):1010-4]. The allegation that the protein bands in Fig. 3D were falsified.

Allegation 5.9: **Paper 5** [*Science* 2004 May 14;304(5673):1010-4]. The allegation that the protein bands in Fig. Supplement S5C were falsified.

Allegation 6: **Paper 5** *Science* 2004 May 14;304(5673):1010-4. We highly suspect that DNA bands in Figs. 4B and 4D were heavily manipulated. Due to our technical limitations, we do not know if these bands were pasted to the blot.

Allegation 6.1: **Paper 5** [*Science* 2004 May 14;304(5673):1010-4]. The allegation that the protein bands in Fig. 4B were falsified.

Allegation 6.2: **Paper 5** [*Science* 2004 May 14;304(5673):1010-4]. The allegation that the protein bands in Fig. 4D were falsified.

Allegation #7

Data fabrications in **Paper 6** *Nature*. 2002 Oct 24;419(6909):857-62.

Coomassie Blue staining of H3, H2B, H2B and H4 bands of lanes 1 and 2 in Fig. 1b and those from lanes 2 and 3 in Fig. 2e are exactly the same and they are also the same from lanes 1 and 2 in Fig. 1B from a different paper (Science 2004 May 14;304(5673):1010-4). These three experiments are completely different.

Allegation #8

Data fabrications in **Paper 6** Nature. 2002 Oct 24;419(6909):857-62. We highly suspect that protein bands in Figs. 1d, 2e, 2d, 4d, 4e, 4g were heavily manipulated. Due to our technical limitations, we do not know if these blots are falsified.

Allegation 8.1: We highly suspect that in **Paper 6** (Nature. 2002) the protein bands in Fig. 1d were heavily manipulated.

Allegation 8.2: We highly suspect that in **Paper 6** (Nature. 2002) We highly suspect that in **Paper 6** (Nature. 2002) Fig. 2b lane 1 is a duplicate copy of lane 3.

Allegation 8.3: We highly suspect that in **Paper 6** (Nature. 2002) the protein bands in Fig. 2e were heavily manipulated. See Allegation 4.

Allegation 8.4: We highly suspect that in **Paper 6** (Nature. 2002) the protein bands in Fig. 4d were heavily manipulated.

Allegation 8.5: We highly suspect that in **Paper 6** (Nature. 2002) the protein bands in Fig. 4e were heavily manipulated.

Allegation 8.6: We highly suspect that in **Paper 6** (Nature. 2002) the protein bands in Fig. 4g were heavily manipulated.

Allegation #9

Data fabrications in **Paper 7** Science. 2006 Feb 24;311(5764):1118-23. Lava staining by in situ hybridization in the lower 3rd panel (UAS-TRE1(+)) and the 10th panel (Hsp70Gal4) in Fig. 6C are exactly the same except for some contrast adjustment. However, they were supposed to be two completely different lavas.

Allegation #10

Paper 7 Science. 2006 Feb 24;311(5764):1118-23.

The PCR bands in electrophoresis gel of the entire paper were very suspicious. If you adjust the contrast/brightness of the blots, the immediate surroundings of these bands are very distinct from the ambient background. However, due to our technical limitations, we could not say conclusively that these blots are falsified.

Allegation 10.1: *That gel bands were spliced into the lower panel of Fig. 4D in Paper 7.*

Allegation 10.2: *That different gels have been spliced together in creating Fig. 6A panel A in Paper 7.*

Allegation 10.3: *That different gels have been spliced together in creating Fig. 6B panel A in Paper 7.*

Allegation 10.4: *That different gels have been spliced together in creating Fig. 6E panel A in Paper 7.*

Allegation 10.5: *That different gels have been spliced together in creating Fig. S5A in Paper 7.*

Allegation 10.6: *That different gels have been spliced together in creating Fig. S12, S13, S14 and S16 in Paper 7.*

Allegation #11 *Data fabrications in Paper 8 Mol Cell. 2011 Sep 16;43(6):1040-6. The DNA electrophoresis of lanes 4-8 and lanes 12-16 in Fig. 4B are almost the same. However, they were supposed to be obtained by two completely different experiments.*

Allegation #12: *Data fabrications in Paper 8 Mol Cell. 2011 Sep 16;43(6):1040-6. The PCR bands in the electrophoresis gel of supplementary Fig. S1C are very suspicious. If one adjusts the contrast/brightness of the blots, the immediate surroundings of these bands are very distinct from the ambient background. However, due to our technical limitations, we could not say conclusively that these blots are falsified.*

Allegation #13: *Silvia Sauer 2005 Nature Manuscript: Referee made allegations that there was fabrication of data in figures and an imaginal disc embryo image from Maile et al. Paper #5.*

Appendix 2 comprises the papers that were alleged to contain manipulated figures:

Paper 1 (IC01)

Frank Sauer, Stig K. Hansen, and Robert Tijian.
Multiple TAF_{II}s Directing Synergistic Activation of Transcription. 1995. *Science* 270, 1783-1788.

Paper 2 (IC02)

Frank Sauer, Stig K. Hansen, Robert Tijian
DNA Template and Activator-Coactivator Requirements for Transcriptional Synergism by *Drosophila* Bicoid. 1995. *Science*. 270, 1825-1828.

Paper 3 (IC03)

Frank Sauer, David A. Wassarman, Gerald M. Rubin, and Robert Tjian
TAF_{II}s Mediate Activation of Transcription in the *Drosophila* Embryo. 1996. *Cell*. 87, 1271–1284.

Paper 3.1 Retraction (IC03.1)

Frank Sauer, David A. Wassarman, Gerald M. Rubin, and Robert Tjian
TAF_{II}s Mediate Activation of Transcription in the *Drosophila* Embryo. 1998. *Cell* 95, 575.

Paper 4 (IC04)

Anh-Dung Pham and Frank Sauer
Ubiquitin-Activating/Conjugating Activity of TAF_{II}250, a Mediator of Activation of Gene Expression in *Drosophila*. 2000. *Science*. 29, 2357-2360.

Paper 5 (IC05)

Tobias Maile, Simona Kwoczynski, Rebecca J. Katzenberger, David A. Wassarman, & Frank Sauer
2TAF1 Activates Transcription by Phosphorylation of Serine 33 in Histone H2B. 2004. *Science*. 304, 1010-1014.

Paper 5.1 Supplemental Materials (IC05.1)

Tobias Maile, Simona Kwoczynski, Rebecca J. Katzenberger, David A. Wassarman, & Frank Sauer
2TAF1 Activates Transcription by Phosphorylation of Serine 33 in Histone H2B. 2004. *Science*. 304, 1 – 18.

Paper 6 (IC06)

Christian Beisel, Axel Imhof, Jaime Greene, Elisabeth Kremmer, & Frank Sauer.
Histone methylation by the *Drosophila* epigenetic transcriptional regulator Ash1. 2002 *Nature* 419, 857-862.

Paper 7 (IC07)

Tilman Sanchez-Elsner, Dawei Gou, Elisabeth Kremmer, Frank Sauer
Non-coding RNAs of trithorax-response elements recruit *Drosophila* Ash1 to *Ultrabithorax*. 2006 *Science* 311, 1118-1123.

Paper 7 Supplemental Materials (IC07.1)

Tilman Sanchez-Elsner, Dawei Gou, Elisabeth Kremmer, Frank Sauer
Non-coding RNAs of trithorax-response elements recruit *Drosophila* Ash1 to *Ultrabithorax*. 2006 *Science* 311, 1 – 29.

Paper 8 (IC08)

Stéphane Bertani, Silvia Sauer, Eugene Bolotin, and Frank Sauer
The Noncoding RNA *Mistral* Activates *Hoxa6* and *Hoxa7* Expression and Stem Cell Differentiation by Recruiting MLL1 to Chromatin. 2011. *Molecular Cell*. 43, 1040–1046.

Paper 8 Supplemental Materials (IC08.1)

Stéphane Bertani, Silvia Sauer, Eugene Bolotin, and Frank Sauer
The Noncoding RNA *Mistral* Activates *Hoxa6* and *Hoxa7* Expression and Stem Cell Differentiation by Recruiting MLL1 to Chromatin. 2011. *Molecular Cell*. 43, 1 - 25.

(b) The support, including, including grant numbers, grant applications, contracts, and publications listing such support

Appendix 3: Proposals submitted and awards received since Dr. Frank Sauer joined UCR. This comprises 34 proposals submitted to the NIH with 3 awards from the NIH, 3 proposals submitted to the NSF and 1 award from the NSF, and one proposal submitted to CIRM (California Institute for Regenerative Medicine) and one award from CIRM over the period 2003 – 2012. **Appendix 3** also identifies which of the eight papers that were the subject of the original allegations were listed in the biography sections, or referenced from these proposals, plus any Figures in the Experimental Plans that reproduce those that have been found to be falsified and fabricated in these eight papers of Dr. Frank Sauer.

Those of the Eight Publications that list this support:

1. Tilman Sanchez-Elsner, Dawei Gou, Elisabeth Kremmer, Frank Sauer
Non-coding RNAs of trithorax-response elements recruit *Drosophila* Ash1 to *Ultrabithorax*. 2006 *Science* 311, 1118-1123. (Paper 7)
Acknowledges: 1 R01 GM073776-01 "RNA - Mediated Recruitment of Epigenetic Regulations"
2. Stéphane Bertani, Silvia Sauer, Eugene Bolotin, and Frank Sauer
The Noncoding RNA *Mistral* Activates *Hoxa6* and *Hoxa7* Expression and Stem Cell Differentiation by Recruiting MLL1 to Chromatin. 2011. *Molecular Cell*. 43, 1040–1046. (Paper 8)
Acknowledges: NIH award 1 R01 GM073776-01 "RNA - Mediated Recruitment of Epigenetic Regulations" and CIRM award RS1-00477-1 "Non-coding RNA as tool for active control of stem cell differentiation"

(c) The specific Allegations of Research Misconduct for consideration in the Investigation

The specific allegations (**Appendix 1**) were received by Executive Vice Chancellor & Provost Dallas Rabenstein on October 3, 2011. To facilitate the initial Inquiry these allegations were organized into twelve (12) separate allegations. The *UCR Policy and Procedures for Responding to Allegations of Research Misconduct* states in Section VII D.4: "The Investigation Committee shall pursue diligently all significant issues and leads discovered that are determined relevant to the Investigation, including any evidence of additional instances of possible Research Misconduct, and continue the Investigation to

completion". This resulted in the original allegations being further subdivided following the discovery of additional instances of data falsification in Dr. Sauer's publications during the Inquiry and Investigation.

(d) The research records and evidence reviewed, and evidence taken into custody.

On October 13, 2011, pursuant to University of California, Riverside Policy Number 529-900, Section VI.C.3, the RIO sequestered evidence relating to the allegations. Ultimately, as described below, the evidence considered by the Committee consisted of (1) materials sequestered from Dr. Sauer's office and lab on October 13, 2011, (2) expert forensic analysis of those materials, (3) independent analysis by *Science* and *Nature*, (4) the evidence provided by Dr. Sauer (**Appendices 8, 9, 22, 23 and 26**), and (5) the Committee's own analysis of all these materials.

In early October 2011, Calforensics of Roseville, California, was retained as an expert in computer forensics to assist with the October 13, 2011 sequestration of the computer files and data located on Dr. Sauer's office computer and personal laptop, as well as each of the shared computers located in Dr. Sauer's lab. Calforensics also copied the hard-drives of two shared imaging instruments. Calforensics continually maintained possession of all digital files copied during sequestration, and throughout the Inquiry and Investigation processes.

Calforensics also assisted the Investigation Committee by conducting a forensic analysis of all the files on these sequestered computers to determine whether images had been digitally manipulated. These analyses are provided in the report from Calforensics (**Appendix 16**) and later referred to in this Investigation Report as "IP" numbered slides (**Appendix 18 – "Analysis of Evidence Slide Set"**) that accompanies this Investigation Report. It should be noted that while Calforensics provided expert analysis of the digital images (see p. 2, second bullet of **Appendix 16**), the Investigation Committee evaluated and interpreted the scientific significance of their findings as well as the materials provided by Dr. Sauer to determine whether or not the manipulations identified by Calforensics comprised research misconduct.

In addition, the Investigation Committee conducted its own analysis of digital files of gel images. The Investigation Report clearly identifies where this was done.

Calforensics imaged the following devices:

- Dell Precision 390, further described as the Gel Imaging Station located in the Boyce Hall;
- Dell Optiplex 780, further identified as the Phosphorous Imaging Machine;
- iMac Powermac 4, further identified as the Sauer Lab Scan Mac;
- Mac Powerbook G4, further identified as the Sauer laptop;
- Compaq Deskpro, further identified as the Sauer Compaq 2;

- Premiomdtpc, further identified as a lab machine;
- A Macintosh computer provided by Dr. Sauer, further identified as the Old Mac;
- A Mac, further identified as the Big Mac containing three hard disk drives; and
- An iMac located in the lab area, further identified as the LabiMac1.

Calforensics reviewed material provided by *Science*, *Nature* and *Molecular Cell* during the Inquiry phase relating to the published articles, manuscripts and figures in question. The published articles will be hereafter referred to as "Paper" and numbered 4 through 8. These papers were the focus of the Investigation Committee as they were from the period of time (after 2000) when the Committee reasonably expected original data and files to have been retained by Dr. Sauer.

On November 17, 2011, Dr. Sauer provided digital files to the RIO (on a set of 12 CDs – **Appendix 8**). Dr. Sauer represented that the files contained the original data and used for the figures referred to in the allegations. Calforensics organized the provided material and reviewed it for relevance to each allegation. In this review, they searched for indicia of manipulation of data. Calforensics defined the term "manipulated" to mean altered, edited or moved. For purposes of this report, such indicia of manipulation includes, but is not limited to, splicing data together, cropping out data, adjusting levels to erase data or using a selection tool to select and apply adjustments to isolated portions of an image.

The Investigation Committee's role was to use their scientific expertise to determine whether such "manipulations" represented research misconduct.

Calforensics searched the hard drive forensic images they acquired October 13, 2011 for files Dr. Sauer may have relied upon in the research and analyzed recovered relevant files to determine the following:

- the origination and authenticity of images;
- the dates the images were created;
- if the images were altered or manipulated; and
- what programs were used to alter images.

In their search for relevant images, Calforensics looked for files with the same file names or created, modified or last accessed dates close to those files provided by Dr. Sauer and reviewed them to determine if they contained the same or similar data represented in the figures in question.

In addition, Calforensics performed control tests to determine the following:

- If the use of a straight edge selection tool to select a band in a Photoshop Document (psd file) and copy and paste of that band elsewhere into the same psd file, results in a visible box around the band that was copied and pasted; and

- if the various indicia of splicing, such as defined boxes around bands, white halos around bands or straight lines around bands noted by *Science*, *Nature* and *Molecular Cell* and noted herein also appear in files that are known to contain unmanipulated data.

In addition, evidence (comprising laboratory note books, x-ray films, and dried gels) was sequestered from Dr. Sauer and employees of his laboratory on October 13, 2011 and are listed in **Appendix 19**.

Chronology

The Allegations were anonymously submitted via email to Dallas L. Rabenstein, Executive Vice Chancellor and Provost of UC Riverside, who received them on October 3, 2011 (**Appendix 1**). The Allegations e-mail was dated September 28, 2011 and reflects that it was also sent to 23 individuals as identified above in Section (iii).

The Inquiry and Investigation chronology is as follows:

October 7, 2011

The RIO had Dr.

assist him in determining whether the Complainants allegations fall within the UC Riverside definition of Research Misconduct, whether the relevant research or research-related activity is of the type covered by the Policy, and whether the Allegation is sufficiently credible and specific so that potential evidence of Research Misconduct may be identified (University of California, Riverside Policy Number 529-900, Section V, Policy and Procedures for Responding to Allegations of Research Misconduct). confirmed that a number of the Complainants' allegations appeared to fall within the UC Riverside definition of Research Misconduct, that the relevant research or research-related activity is of the type covered by the Policy, and that the Allegation is sufficiently credible and specific so that potential evidence of Research Misconduct may be identified.

October 9, 2011

Based on the analysis by and the RIOs own assessment of the allegations, the RIO informed the UC Riverside EVC & Provost Dallas Rabenstein that he had decided to proceed with a formal Inquiry of the allegations in accordance with the University of California, Riverside Policy Number 529-900, Section V, Policy and Procedures for Responding to Allegations of Research Misconduct.

October 12, 2011

The Research Integrity Officer ("RIO"), Dr. Charles F. Louis, tasked the Inquiry Committee to determine whether there was sufficient substance to the allegations against Professor Frank Sauer to warrant a formal Investigation of research misconduct (**Appendix 4**). The Inquiry Committee held its first meeting on October 17, 2012.

October 13, 2011

The Research Integrity Officer met with Dr. Sauer to advise him of the allegations made against him and that a preliminary assessment of the Allegations had determined a formal Inquiry into the allegations was appropriate. At that time, the RIO provided Dr. Sauer with a copy of the e-mail dated September 28, 2011 that contained the allegations, a copy of UC Riverside's Policy and Procedures for Responding to Allegations of Research Misconduct, and the letter of appointment of Inquiry Committee members. (Dr. Sauer did not subsequently object to the appointment of any Committee member.) Dr. Louis also requested and received Dr. Sauer's permission to proceed with an initial interview, described in further detail below.

At the time of the interview, per UC Riverside's Policy and Procedures for Responding to Allegations of Research Misconduct, the RIO requested Dr. Sauer provide him (the RIO) with all materials relating to the publications listed in the allegations. Dr. Sauer then assisted with locating all the laboratory notebooks, binders, film boxes, files and other research materials associated with the papers listed in the allegations of research misconduct. It was immediately apparent that these materials were not maintained in an organized fashion. Dr. Sauer pulled materials from assorted locations in his office and the room immediately outside his office. He also took an x-ray film from his desk that he said was from an experiment in the 1990s when he was a postdoc at UC Berkeley. Most disconcerting was the manner in which old x-ray films were maintained in used x-ray film boxes. They appeared to have been stuffed in with no apparent order. Further, most films were undated requiring Dr. Sauer to view the x-ray to make a guess as to whether it was associated with a specific experiment that had then been used for a figure in one of the eight papers that are the subject of the allegations.

All research materials provided by Dr. Sauer were inventoried and logged by the RIO's staff in Dr. Sauer's presence. The inventoried items were sequestered in a locked office in the UC Riverside Office of Research Integrity throughout the Inquiry and Investigation processes. The materials were moved to a secured office of the UC Riverside Campus Council on 6/22/12.

October 13, 2011 Interview with Dr. Frank Sauer

Dr. Sauer gave his permission to tape the interview at the start of the interview. He briefly reviewed the Allegation. He stated that he had a collection of notebooks and films he would need to review and that he would have to look at his materials "piece by piece".

Dr. Sauer provided a general description of his procedures for collecting, saving and storing data for publication. He uses shared digital image collectors. Generally, images are collected at the end of an experiment and stored by students as electronic files and then extracted. Final assembly is done by Dr. Sauer on his office computer. The captured electronic images are likely to be found on Dr. Sauer's computer. He said that his former students may have saved some images on their computers.

Dr. Sauer said that he looks at the physical images captured. According to him, all of the final assembly is done by Dr. Sauer. He uses Photoshop and then assembles the images in Illustrator software. The final assembly is done on Dr. Sauer's computer before a paper is sent to a journal.

Dr. Sauer further stated that his 1996 *Cell* paper (Dec 27; 87(7):1271-84) was retracted in 1997 because the staining data in one of the figures was not reproducible. He said that he had not been previously accused of research misconduct.

After reviewing the Allegations a second time, Dr. Sauer stated that he had additional data in lab books, files and film or image boxes stored in his office and in the lab. He stated that the notebooks for his most recent paper (*Molecular Cell*, 2011 Sep 16;43(6):1040-6) were in the labs; however, he was unable to locate the notebooks when searching for them immediately subsequent to the interview.

October 13, 2011 Interview with

was briefly interviewed by the Research Integrity Officer on October 13, 2011, immediately following the interview with Dr. Sauer

runs radiological experiments and works with physical data. collects, labels and scans gel images using several different scanners. Dr. Frank Sauer and a graduate student assemble the images for papers.

According to , the x-ray films from the experiments are usually labeled. The best ones are given to Dr. Sauer. Some poor examples are kept if the film is to be part of a paper; Dr. Sauer sometimes asked for a different exposure.

October 14, 2011

The RIO requested Dr. Sauer's assistance in more specifically locating exactly which experiments, films, figures, images and other data contained in which particular item of sequestered materials were associated with the various figures identified in the allegation (**Appendix 1**).

October 19, 2011 and October 20, 2011

The Senior Paralegal Specialist assisting the RIO met with Dr. Sauer at the Office of Research Integrity. Dr. Sauer reviewed the anonymous Allegations (**Appendix 1**) and suggested which research data had been utilized in generating each of the figures (which are the subject of the allegations) in the papers accepted for publication by the journals (**Appendix 5**). Dr. Sauer was unable to identify with certainty the location of most of the underlying data relating to these papers.

October and November 2011

The RIO requested and received assistance in analyzing the figures that were the subject of the allegations from each of the journals (*Nature*, *Science* and *Molecular Cell*). In addition to the figures identified in the Allegations, personnel at *Science* magazine identified additional figures (**Appendix 7**) that had been possibly falsified or

fabricated in one of Dr. Sauer's *Science* papers (Table 1). These figures were therefore added to the original anonymous Allegations (**Appendix 1**). The Inquiry Committee also requested that Dr. Sauer further assist with identifying the physical data and computer files containing the figures that were the subject of the allegations. *Nature* provided **Appendix 6** on 11/9/11 and *Science* provided **Appendix 7**, a series of electronic file images, on 11/18/11 and 12/20/11.

November 17, 2012

Dr. Sauer provided 12 CDs that he said contained images and original data used for creating the figures referred to in the anonymous Allegations (**Appendix 8**). Because of the disorganization of these materials, it was very difficult to determine which folders and files among the various CDs contained the specific figures Dr. Sauer used in his published papers.

December 1, 2011

The RIO asked Dr. Sauer to provide a catalog with the name of the specific CD and the name of each folder and file on that CD that contained the original data (i.e. the original blots/gels images) for the figures that were submitted to the journals.

December 13, 2011.

Dr. Sauer provided a deconstruction of this information and its use in identifying original data on the computers sequestered 10/13/11 by the external computer forensics consultant Calforensics. The information Dr. Sauer provided was not reviewed by the Inquiry Committee prior to the final meeting of the Committee that was held on December 7, 2011 (**Appendix 9**).

December 7, 2011

The Inquiry Committee concluded that there was sufficient substance to the allegations to warrant a formal Investigation. To assist in tabulating the allegations, the Committee segregated them into 12 separate allegations with some of the allegations containing more than a single allegation. The Inquiry Committee concluded that of the twelve specific allegations, Allegations 1, 2, and 11, as well as some of the separate allegations in Allegations 8 and 10 (see Table 2) be dismissed.

The Inquiry Committee requested that Calforensics focus its analysis on the computer files that were identified by Dr. Sauer as being associated with the nine allegations that the Committee recommended being investigated by an Investigation Committee (**Appendix 10**).

December 23, 2011

The Inquiry Report was sent to Dr. Sauer who received it by FEDEX on December 27, 2011 (**Appendix 10**). Dr. Sauer was given until January 12, 2012 to provide any response to the conclusions of the Committee.

January 12, 2012

Dr. Sauer provided a written response to the Inquiry Report on this date (**Appendix 11**). The Committee subsequently reviewed Dr. Sauer's response and unanimously agreed that his response did not change their conclusion that there was sufficient substance to the anonymous Allegations to warrant a formal Investigation.

January 18, 2012

Inquiry Reports were submitted to the Office of Research Integrity (**Appendix 12**) and Office of the Inspector General at the National Science Foundation (**Appendix 13**).

February 1, 2012

The Investigation Committee was appointed and tasked to decide whether there was sufficient substance to the allegations against Professor Frank Sauer to determine whether Research Misconduct has occurred, and, if so, to determine the responsible person, the seriousness of the misconduct, and recommendations with respect to the imposition of disciplinary sanctions (**Appendix 14**).

May 9, 2012

Interviews with
transcripts).

(**Appendix 15** for

Thursday May 10, 2012

Interviews with

(**Appendix 15** for transcripts).

Friday May 11, 2012

Interviews with
(**Appendix 15** for transcripts).

Friday May 25, 2012

Interviews with Dr. Frank Sauer and occurred on this date(**Appendix 15** for transcripts). During Dr. Sauer's interview, he produced new x-ray and gel image data that he claimed would show that there had been no manipulation of gel images and that the allegations were false.

However, on October 13, 2011 the RIO Dr. Louis had handed a copy of the UCR Research Misconduct policy to Dr. Sauer and requested at that time that he provide the RIO, Dr. Louis, with all pertinent and original materials. The materials Dr. Sauer was asked to provide included all lab notebooks, binders, film boxes, digital files and other research materials associated with the papers listed in the allegation of research misconduct. Dr. Sauer's failure to provide these items for sequestration to the RIO Dr. Louis, as requested on October 13, 2011, meant that the Committee could not be assured that the figures it received on May 25, 2012 were actually associated with the papers as described by Dr. Sauer. Thus, the Committee was not persuaded that these materials supported Dr. Sauer's position.

Also on May 25, 2012, Dr. Louis sent a letter to Dr. Sauer's attorney requesting that the original materials brought by Dr. Sauer to his interview be immediately provided to the Committee (**Appendix 20**). When no response was received, this request was followed by another letter on June 6, 2012 again requesting the materials (**Appendix 21**).

June 18, 2012

After significant negotiations, Dr. Sauer's attorney agreed to send all of the new, unsequestered materials brought by Dr. Sauer to his May 25, 2012 interview to the PHS Office of Research Integrity (ORI) with a list of what evidence related to which figures (**Appendix 22**).

June 26, 2012

The RIO reviewed all the new, unsequestered materials submitted by Dr. Sauer to the ORI on 6/18/12 in the presence of _____, Scientist-Investigator at the ORI. _____ provided the RIO with quality copies of all the materials. The RIO subsequently provided the copies to the Investigation Committee for their review.

July 2, 2012

Dr. Sauer provided the RIO with digital files of many of the materials that Dr. Sauer initially provided to the ORI on 6/18/12. On 7/5/12, Dr. Sauer gave the RIO the original files names of the digital files. The RIO subsequently made the digital files available to the Investigation Committee for their review.

July 3, 2012

Dr. Sauer requested an opportunity to review all of the laboratory notebooks and films that were sequestered from his laboratory on October 13, 2011 (**Appendix 19**). The review was conducted on this date in the presence of the RIO Dr. Charles Louis, and the Assistant to the Campus Counsel Ms. Regina Luz Villasenor. Dr. Sauer requested copies of five (5) pages from these materials; the five (5) pages were photocopied and provided to Dr. Sauer on 7/5/12.

September 4, 2012

Dr. Sauer received a draft copy of the Investigation Report and was given 30 days to provide a written response.

October 5, 2012

Dr. Sauer provided the Investigation Committee with a written response to the draft Investigation Report.

(e) Provide a finding as to whether Research Misconduct did or did not occur for each separate Allegation of Research Misconduct identified during the Investigation.

Standards for presentation of images derived from gel electrophoresis experiments

The Committee reviewed the figure submission policies of the major journals in the field in which Dr. Sauer published (**Appendix 17**). Most of the allegations made against Dr. Sauer concern the manipulation of gel images. The following selections from the scientific journals in which Dr. Sauer published make clear their requirements for preparation of gel images to be used in figures subsequently submitted to their journals:

Nature's "Image Integrity Policy" states that "Quantitative comparisons between samples on different gels/blots are discouraged; if this is unavoidable, the figure legend must state that the samples derive from the same experiment and that gels/blots were processed in parallel. Vertically sliced images that juxtapose lanes that were non-adjacent in the gel must have a clear separation or a black line delineating the boundary between the gels. Loading controls must be run on the same blot." (underlining added) and,

"High-contrast gels and blots are discouraged, as overexposure may mask additional bands. Authors should strive for exposures with gray backgrounds." (underlining added) and,

"Processing (such as changing brightness and contrast) is appropriate only when it is applied equally across the entire image and is applied equally to controls. Contrast should not be adjusted so that data disappear." (underlining added)

In a similar vein, *Science* states that it "does not allow certain electronic enhancements or manipulations of micrographs, gels, or other digital images. Figures assembled from multiple photographs or images, or non-concurrent portions of the same image, must indicate the separate parts with lines between them. Linear adjustment of contrast, brightness, or color must be applied to an entire image or plate equally. Nonlinear adjustments must be specified in the figure legend. Selective enhancement or alteration of one part of an image is not acceptable." (underlining added)

The *Journal of Cell Biology* policy states: "No specific feature within an image may be enhanced, obscured, moved, removed, or introduced. The grouping of images from different parts of the same gel, or from different gels, fields, or exposures, must be made explicit by the arrangement of the figure (i.e., using dividing lines) and in the text of the figure legend. Adjustments of brightness, contrast, or color balance are acceptable if they are applied to every pixel in the image and as long as they do not obscure, eliminate, or misrepresent any information present in the original, including the background. Non-linear adjustments (e.g., changes to gamma settings) must be disclosed in the figure legend." (underlining added)

That these journals' standards are the "accepted practices of the Dr. Sauer's research community" as defined in the University of California, Riverside Policy Number 529-900, Policy and Procedures for Responding to Allegations of Research Misconduct was documented in the interviews with witnesses regarding the presentation of images derived from gel electrophoresis experiments. Thus, (Appendix 15) stated that "the problem with splicing (gel lanes) is that you have to say that you actually did

the splicing" (p. 39). subsequently sent the Committee a later paper he published containing an example of how this should be done: by placing black or white lines between the individual gel lanes (see Fig. 4A in **Appendix 25**). The Committee explicitly questioned Dr. Frank Sauer on the issue of the presentation of spliced gel lanes in journal figures (**Appendix 15**). It also read him a selection of the journal policy statements regarding the presentation of images used in the preparation of gel images for publication. Dr. Sauer concurred that these statements were correct; he agreed with the journal policies regarding the figures he had prepared for submission to journals (see pp 28 – in Frank Sauer transcript). Thus, Dr. Sauer agreed with and confirmed with the Committee that he was required to comply with the journal policies for preparing figures for publication.

The one statement with which Dr. Sauer did not completely agree was a section of the *Journal of Cell Biology* policy regarding the presentation of gel image data. This section states: "High-contrast gels and blots are discouraged as overexposure may mask additional bands. Authors should strive for exposures with gray backgrounds." Dr. Sauer responded that "Well, I would say whenever it's possible, it's -- I think that that depends on the experiment itself in any case. I mean, they should strive. It's not a rule that they require, but I think that it depends on your experiment and some that's possible, and some it would never be used." (p. 37 - 38). Many of the concerns of *Science* (**Appendix 7**) and the Investigation Committee raised in this Report are exactly because of the possibility that by overexposing gel images Dr. Sauer may have masked additional bands in the original experimental data.

The Committee sought Dr. Sauer's assurance that he understood and complied with the journals' policies for authors. Based on the questioning of Dr. Sauer in his 5/25/12 interview, he confirmed that he understood these policies and largely agreed with them. However, the Committee noted that Dr. Sauer never indicated that he had told the journals he was departing from their publication requirements. In fact, in his interview with the Committee, Dr. Sauer acknowledged that a previous publication (**Paper 3** in 1996) had been retracted from *Cell* because of a quality control issue. This acknowledgment indicates that Dr. Sauer continued to practice the same disregard for journal policies regarding the preparation of gel images for the figures in his manuscripts over a significant period of time (for his 2004 – 2011 publications). Thus, the multiple findings of research misconduct because of the manipulation of gel images over a significant period of time documented in this Report demonstrate a pattern of research misconduct. It meets the applicable evidentiary standards to show that this conduct was at a minimum recklessness, and in some instances, the research misconduct was committed intentionally and knowingly. These instances of research misconduct were a significant departure from accepted practices of Dr. Frank Sauer's research community.

ANALYSIS OF THE INDIVIDUAL ALLEGATIONS

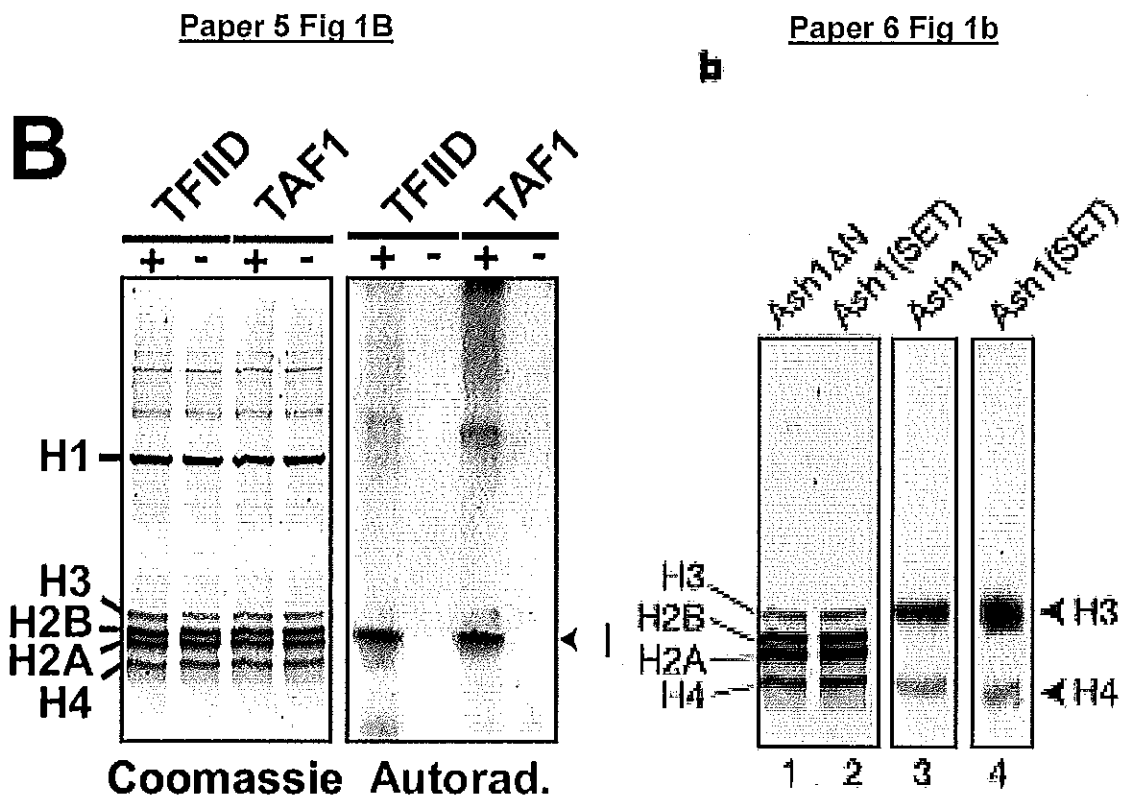
Allegations Confirmed to be Research Misconduct by the Committee

Allegation #4

III. Data fabrications in **Paper 5** *Science* 2004 May 14;304(5673):1010-4.

2. Coomassie Blue staining of H3, H2B, H2A and H4 bands of lanes 1 and 2 in Fig. 1B are exactly the same of those of lanes 1 and 2 in Fig. 1b and those from lanes 2 and 3 in Fig. 2e from a different **Paper 6** (*Nature*. 2002 Oct 24;419(6909):857-62). These three experiments are completely different.

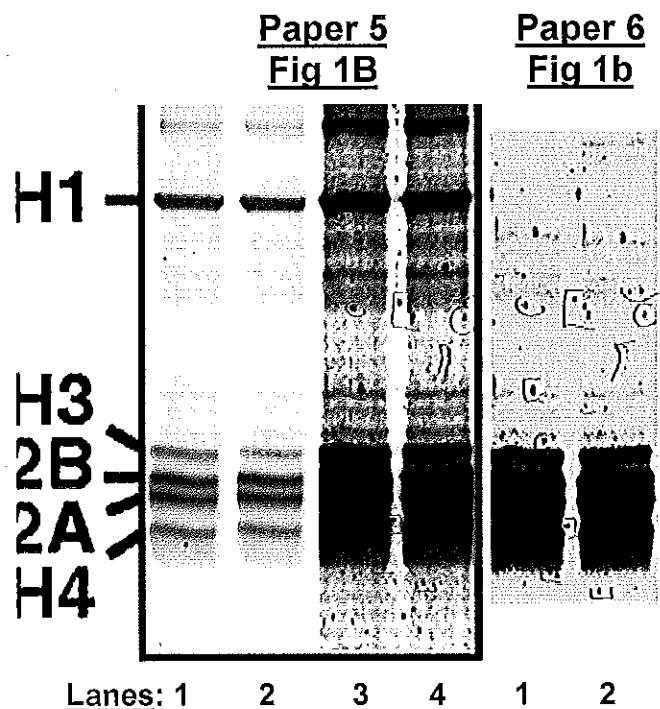
Original Figures submitted by Dr. Sauer to Journals



Allegation 4.1 The allegation that Fig 1b in **Paper 6** (*Nature* 2002) was duplicated to produce Fig 1b in **Paper 5** (*Science* 2004).

Nature compared the archive version of the *Nature* (**Paper 6**) Figure 1b with the *Science* (**Paper 5**) Figure 1B, and found apparent duplication between the two.

Figure provided in *Nature* e-mail to CFL 11/9/11 (Appendix 6)



The above shows Figure 1B from *Science* (Paper 5) on the left (with lanes 3 and 4 contrast enhanced) compared to *Nature* (Paper 6) Figure 1b lanes 1 and 2 on the right. With contrast enhancement, even though the images are at different resolutions and contrasts, the specks on the gel highlighted in red indicate the two pairs of lanes are the same.

An additional observation noted by *Nature* was that the top of the gel from Paper 6 Figure 2e doesn't match the bands at the top of the gel from Paper 5, indicating that splicing has occurred (and Figure 2e also has a blank space in the middle of the lanes with no background).

Dr. Sauer provided the RIO with the following digital images (**Appendix 8** – that the RIO provided to Calforensics) as being relevant to **Figure 1B** in Paper 5:

- TFIID-kinase assay.psd, last modified 12/10/2000 9:44 AM.
- TFIID nucleosomen coomassie.psd, last modified 1/12/2001 9:06 AM;
- TFIID nucleo kinase autorad.psd, last modified 1/17/2001 3:07 PM;

- histones kinase assay scan gel, last modified 1/20/2001 11:17 PM; and
- histones kinase assay.psd, last modified 1/26/2001 7:08 PM.

Califorensics reviewed the hard drive forensic images they acquired from Dr. Sauer's sequestered computers. They found no files relevant to this figure.

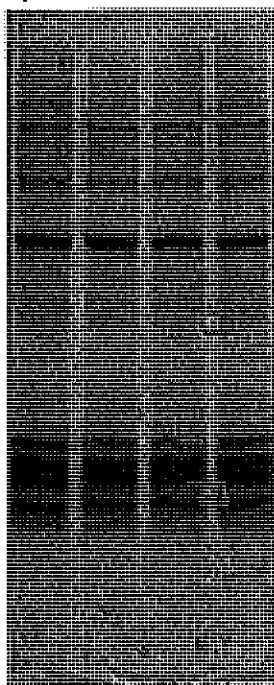
Dr. Sauer provided the RIO with the following digital images (**Appendix 8** – that the RIO provided to Califorensics) as being relevant to **Figure 1b** in Paper 6:

- Ash1 HMT test Coomassie gel.psd, last modified 11/3/2001 11:28 PM; and
- nucleosomen.psd, last modified 11/4/2001 9:58 PM.

Califorensics reviewed the hard drive forensic images they acquired from Dr. Sauer's sequestered computers. They found no files relevant to this figure.

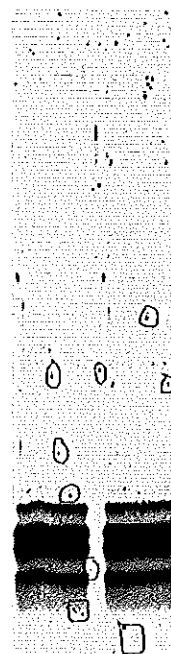
In Californsic's forensic examination of the files provided to the RIO for Paper 5 Figure 1B, and Paper 6 Figure 1b, they reviewed TFIID nucleosomen coomassie.psd, last modified 1/12/2001 9:06 AM (Paper 5, Figure 1B), which appears as if it could reflect an original gel image, and nucleosomen.psd, last modified 11/4/2001 9:58 PM (Paper 6, Figure 1b). As illustrated below by over markings, the bands, lanes and artifacts in both images appear the same, i.e. in TFIID nucleosomen coomassie.psd, last modified 1/12/2001, and nucleosomen.psd, last modified 11/4/2001 the specks on the gel highlighted in red indicate the two pairs of lanes are the same, with adjustments to levels and/or brightness and contrast to the image represented in nucleosomen.psd (in Paper 6) to create the image represented in TFIID nucleosomen coomassie.psd (in Paper 5).

TFIID nucleosomen coomassie.psd
1/12/2001 9:06 AM
(Paper 5, Figure 1B)



Lanes: 1 2 3 4

TFIID nucleosomen.psd
11/4/2001 9:58 PM
(Paper 6, Figure 1b)



Lanes: 1 2

To resolve the possibility that some of the artifacts, which appear as specks, could have been specks or debris on the imaging lens, Calforensics reviewed other files that appeared to contain gel scans created around the same dates (1/12/2001 and 11/4/2001). However, they did not observe any file with a similar pattern of specks as seen in the images in question so they concluded that TFIID nucleosomen coomassie.psd, last modified 1/12/2001, and nucleosomen.psd, last modified 11/4/2001, are likely representative of the same original experimental data but with adjustments to levels and/or brightness and contrast to the image represented in TFIID nucleosomen coomassie.psd (in Paper 5) to create the image represented in nucleosomen.psd (in Paper 6).

On 6/18/12 Dr. Sauer presented a number of items of evidence that he claimed were the original data for Paper 5 Figure 1B, and Paper 6 Figure 1b (Items 16, 22, 28, 29, 30, 31, 32, 33, and 40). Items 22 and 40 were claimed to have been used for paper 5, Fig. 1B, and Items 16, 30 and 31 were claimed to have been used for Paper 6, Fig 1b, but it is not clear which of these Items were used for which figures because of the background specks that were identified by both *Nature* and Calforensics in these figures and no other images of figures from this same time in exactly the same position on gels. Careful examination shows that the Item 16 Coomassie gel image (identified as Item 16b by Dr. Sauer) was not the same experiment that represented in the final figure in Paper 6 Fig. 1b. Because these items were not provided to the RIO Dr. Louis, as requested on October 13, 2011, and therefore were not sequestered, there was no assurance that these figures were actually associated with these papers. Thus, the committee was not persuaded that these materials supported Dr. Sauer's position.

Allegation 4.1: Investigation Committee Conclusions

The Committee concluded that Paper 6 Figure 1b lanes 1 & 2 were replicated to produce Paper 5 Figure 1B lanes 3 & 4. Based upon a preponderance of the evidence, the Committee concludes this act is research misconduct because it constitutes data falsification and fabrication. Further, such conduct represents a significant departure from the accepted practices of Dr. Sauer's research community, and by its nature, it was committed intentionally and knowingly.

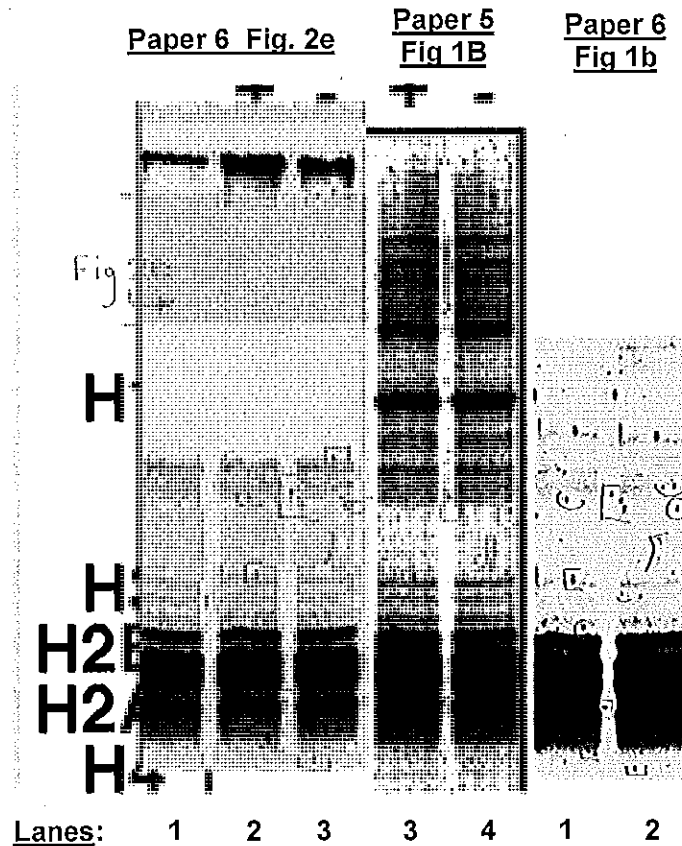
Allegation 4.2: *The allegation that Fig 1b in Paper 6 (Nature 2002) was duplicated to produce Fig 2e in Paper 6.*

Nature concluded that as shown in the annotated figure they provided shown below, the bottom half of lanes 2 and 3 of Figure 2e from Paper 6 (on left) appears the same as Figure 1B from paper 5 (middle two lanes) and again the same as Figure 1b from Paper 6 (on right)

Note that in in the annotated figure shown below that *Nature* provided, the bands at the top of the gel from paper 6 Figure 2e don't match the bands at the top of the gel from 6

Figure 1b or Paper 5 Fig. 1B, indicating that splicing has occurred (and paper 6 Figure 2e also has a blank space in the middle of the lanes with no background).

Figure provided in *Nature* e-mail to CFL 11/9/11 (Appendix 6)



Dr. Sauer provided the RIO with the following digital images (**Appendix 8** – that the RIO provided to Calforensics) as being relevant to **Figure 1b** in Paper 6:

- Ash1 HMT test Coomassie gel.psd, last modified 11/3/2001 11:28 PM; and
- nucleosomen.psd, last modified 11/4/2001 9:58 PM.

Calforensics reviewed the hard drive forensic images they acquired from the sequestered computers. They found no files relevant to this figure.

Dr. Sauer provided the RIO with the following digital images (**Appendix 8** – that the RIO provided to Calforensics) as being relevant to **Figure 2e** in Paper 6:

- ash1 mutanten elu.psd, last modified 11/3/2001 9:34 PM; and
- ASH_nucleosomen.psd, last modified 11/4/2001 10:36 PM.

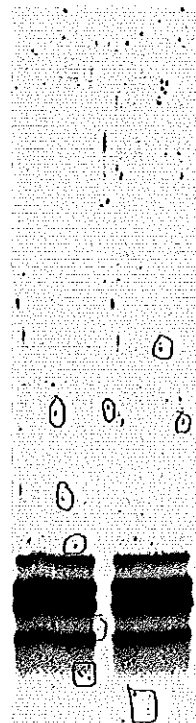
Califorensics reviewed the hard drive forensic images they acquired from the sequestered computers and found no files relevant to this figure.

Califorensics reviewed the two psd files Dr. Sauer suggested to be relevant to Paper 6, Figure 2e (ash1 mutanten elu.psd, last modified 11/3/2001 9:34PM, and ASH nucleosomen.psd, last modified 11/4/2001 10:36PM). The latter file appears to be an edited version of the earlier file with additional bands removed. While they observed no indications of splicing as noted by *Nature* in these images, based on their analysis of specks on the gel highlighted in red, they concluded the data in the bottom portion of lane 2 in ash1 mutanten elu.psd (i.e. paper 6 Fig 2e) is the same as the data in the bottom portion of lane 1 in TFIID nucleosomen.psd (i.e. Paper 6 Fig 1b).

Califorensics concluded that the data in the bottom portion of lane 3 in ash1 mutanten elu.psd, however, does not appear to be the same as the data in the bottom portion of lane 2 in nucleosomen.psd, i.e, lane 3 in ash1 mutanten elu.psd is not the same as lane 2 in the originally submitted figure (see IC14). Therefore, although they observed no indicia of splicing in the files provided by Dr. Sauer, they concluded that the data represented in Paper 6, Figure 2e would have had to have been modified in some way to produce the final image submitted to the journal.

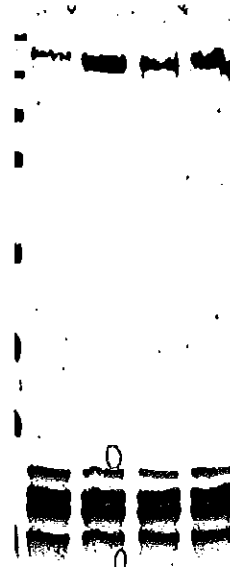
Thus this file ash1 mutanten elu.psd could not have been the one used to generate Paper 6, Fig 2e so these were not the files submitted to *Nature* by Sauer. The analysis by *Nature* was of the files that had been submitted to them by Sauer.

nucleosomen.psd
11/4/2001 9:58 PM
(Paper 6, Figure 1b)



Lanes: 1 2

ash1 mutanten elu.psd
11/3/2001 9:34 PM
Paper 6, Figure 2e



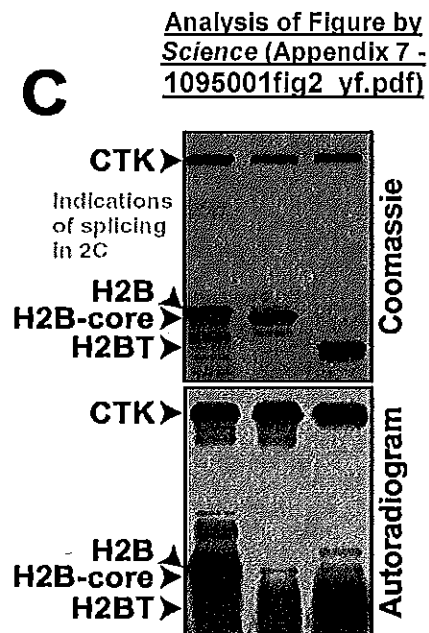
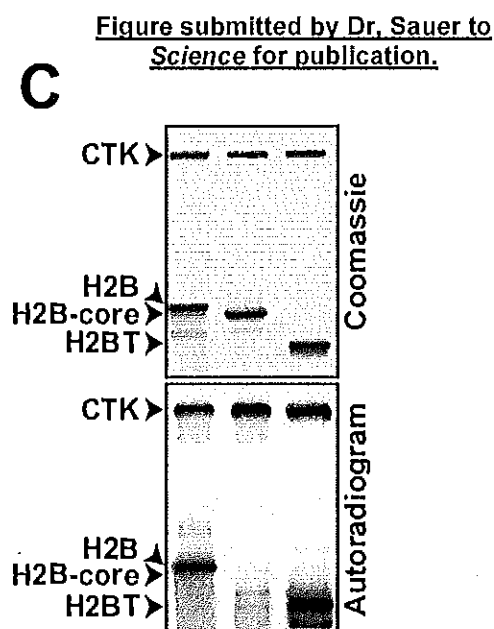
Lanes: 1 2 3 4

On 6/18/12 Dr. Sauer presented a number of items of evidence that he claimed were the original data for Paper 6 Fig. 2e (Items 23, 24, 25, 26 and 28) but there was no way of ascertaining this statement. Because of the background specks that were identified by both *Nature* and Calforensics in these figures and no other images of figures from this same time in exactly the same position on gels, it is not clear which of these Items were used for which figures. Item 26 is a Coomassie gel image that could have been used to generate Paper 6 Fig 2e although it had none of the background specs on it that were identified by *Nature* and Calforensics. Because these items were not provided to the RIO Dr. Louis, as requested on October 13, 2011, and therefore were not sequestered, there was no assurance that these figures were actually associated with these papers. Thus, the committee was not persuaded that these materials supported Dr. Sauer's position.

Allegation 4.2: Investigation Committee Conclusions

The Committee concluded that Paper 6 Figure 1b lanes 1 & 2 were replicated to produce Paper 6 Figure 2e lanes 2 & 3. Based upon a preponderance of the evidence, the Committee concludes this act is research misconduct because it constitutes data falsification and fabrication. Further, such conduct represents a significant departure from the accepted practices of Dr. Sauer's research community, and it was committed intentionally and knowingly.

Allegation 5.4: Paper 5 [Science 2004 May 14;304(5673):1010-4]. The allegation that the protein bands in Figs. 2C were heavily manipulated.



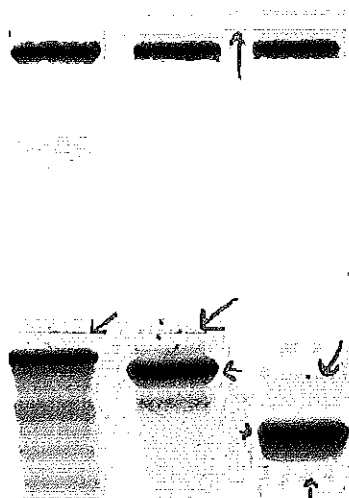
Science concluded there was evidence of splicing of gel lanes in Fig. 2C of Paper 5.

Dr. Sauer provided the RIO with the following digital images (Appendix 8 – that the RIO provided to Calforensics) as being relevant to Figure 2C:

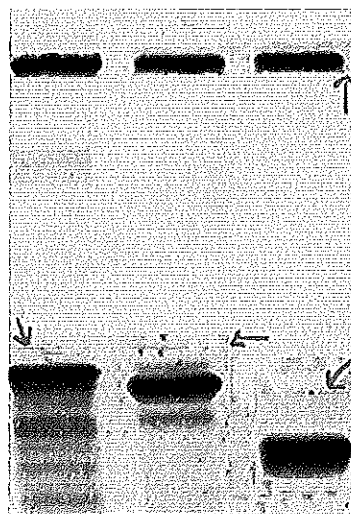
- H2B-Core-Peptide-Coomassie.psd, last modified 3/10/2004 1:47 PM;
- H2B-Core-Peptide.psd, last modified 3/10/2004 2:12 PM; and
- 1095001fig2.eps, last modified 4/14/2004 7:53 AM.

Calforensics reviewed the two psd files suggested by Dr. Sauer as being relevant to Figure 2C. With some adjustment to levels, they observed multiple artifacts indicating bands had been spliced into the image (red arrows below). Therefore, after examination of these two files provided by Dr. Sauer and observance of splicing in these two files, Calforensics concluded that experimental data for Figure 2C was manipulated. This is seen more clearly in the enlarged version IC19

H2B-Core-Peptide-Coomassie.psd
3/10/2004 1:47 PM



H2B-Core-Peptide.psd
3/10/2004 2:12 PM



On 6/18/12 Dr. Sauer presented Item 52 that he claimed was copy of the original Coomassie Blue gel for paper 5, Fig. 2C with writing in felt tip pen in the areas where Calforensics had indicated bands appeared to have been spliced into the image (figures above). Item 52 was a very low resolution Photoshop image file (possibly of a xerox copy) and it was impossible to determine whether this had been one original gel or a spliced ensemble of gel bands to produce the final image as identified by Calforensics. Because these items were not provided to the RIO Dr. Louis, as requested on October 13, 2011, and therefore were not sequestered, there was no assurance that these figures were actually associated with these papers. Thus, the Committee was not persuaded that these materials supported Dr. Sauer's position.

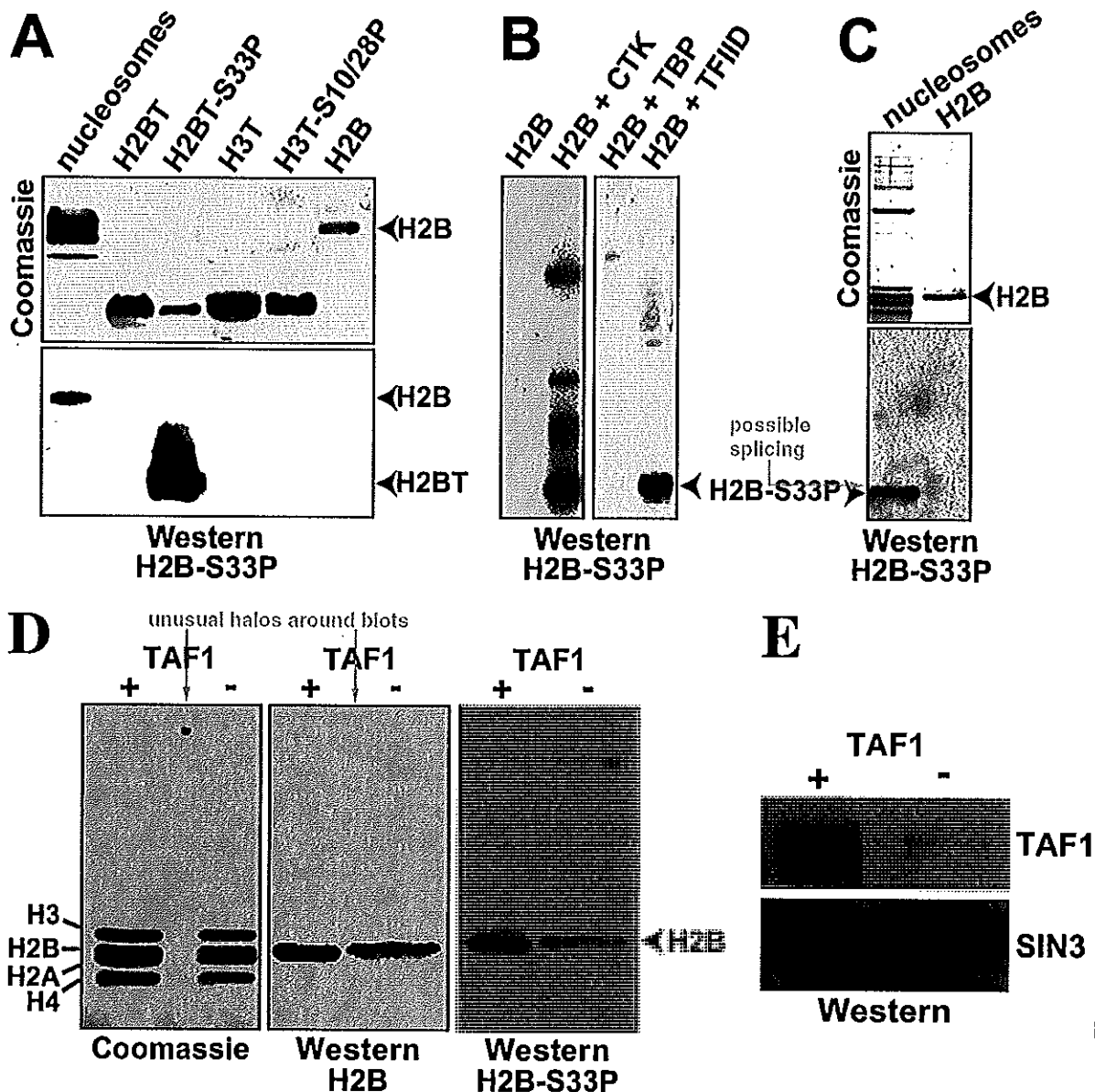
Allegation 5.4: Investigation Committee Conclusions

The Committee concluded that Paper 5 Figure 2C contained multiple artifacts indicating the gel image was directly manipulated to remove or hide critical portions of the gel image. Based upon a preponderance of the evidence, the Committee concludes this act is research misconduct because it constitutes data falsification and fabrication. Further, such conduct represents a significant departure from the accepted practices of Dr. Sauer's research community, and at a minimum, this conduct was committed recklessly.

Allegation 5.6: Paper 5 [*Science* 2004 May 14;304(5673):1010-4]. The allegation that the protein bands in Fig. 3B was falsified.

Science identified an additional figure (Figure 3 – *Science* annotations shown below) in Paper 5 that appeared to comprise a band that had been spliced into the gel lane.

Appendix 7: *Science* communication 11/18/11: [1095001fig3_yf_2 of 2.pdf]

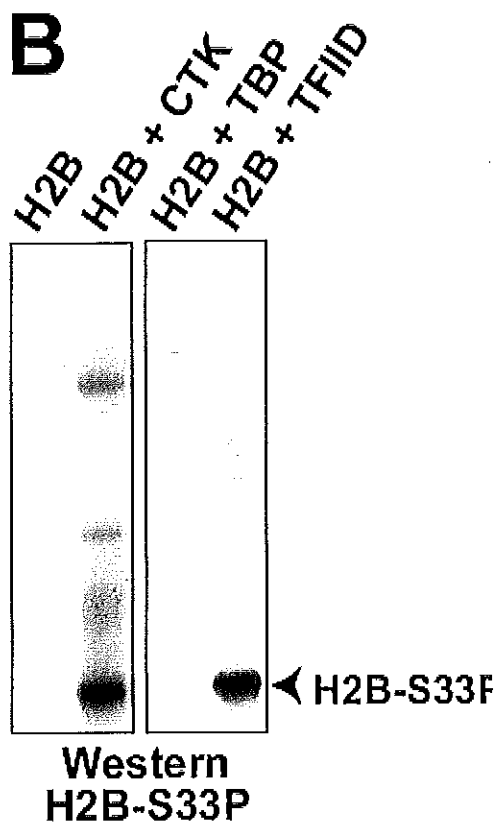


Dr. Sauer provided the RIO with the following digital images (**Appendix 8** – that the RIO provided to Calforensics) as being relevant to **Figure 3B**:

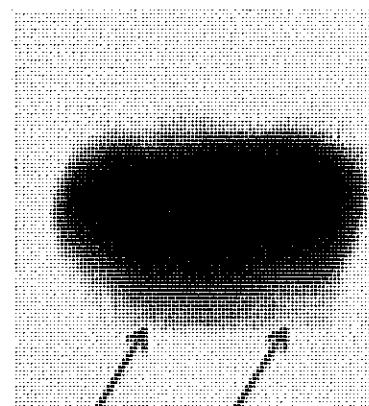
- TFIID-Western-Blot-h2B-S33.psd, last modified 12/11/2003 2:56 PM;
- H2B-antibody-western1.psd, last modified 3/26/2004 5:25 PM; and
- 1095001fig3.eps, last modified 4/14/2004 7:55 AM.

Original Fig. 3B Paper 5
submitted by Sauer to *Science*

H2B-antibody-western1.psd
3/26/2004 5:25 PM



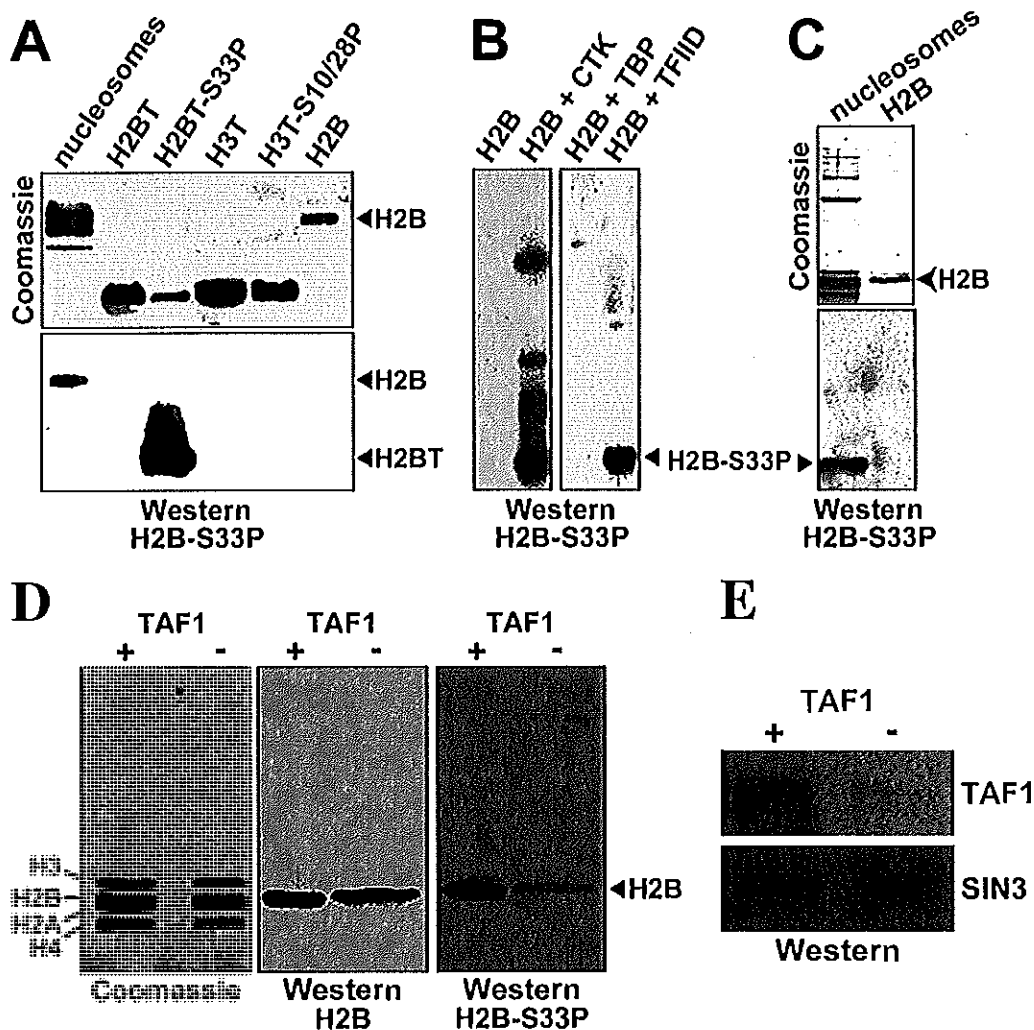
Photoshop adjusted image of band in H2B-antibody-western1.psd 3/26/2004 5:25 PM File adjusted so its width compared with that in the Fig 3B Paper 5 – note pronounced sharp lower edge to band:



Note pronounced flat edge to band

Califorensics reviewed the digital images provided to the RIO by Dr. Sauer (**Appendix 8**) that Dr. Sauer suggested were relevant to Paper 5 Figure 3B and observed that the two psd files contain the black bands on solid white backgrounds as seen in the final figure. Dr. Sauer provided the file H2B-antibody-western1.psd, last modified 3/26/2004 5:25PM. This file appears to contain the image represented in the right panel in the final figure. After applying adjustments to the image in this file, Califorensics observed the artifact noted by *Science*. They concluded that this artifact is indicia of using a selection tool to select the band and make some sort of alteration, such as an adjustment of levels or brightness/contrast, or indicia of masking the image to isolate the band and make an adjustment to the band. They also observed, after applying adjustments, the artifact observed by *Science* in the Sauer provided file 1095001fig3.eps, last modified 4/14/2004 (see figure below). Therefore, although no original scan is available, the Committee concluded that due to the indicia of alterations in the files provided by Dr. Sauer, experimental data for Figure 3B was falsified.

1095001fig3.eps
4/14/2004 7:55 AM



Allegation 5.6: Investigation Committee Conclusions

The Committee concluded that Paper 5 Figure 3B had indicia of using a selection tool to select the band and make some sort of alteration to the Western image. Based upon a preponderance of the evidence, the Committee concludes this act is research misconduct because it constitutes data falsification. Further, such conduct represents a significant departure from the accepted practices of Dr. Sauer's research community, and this conduct was committed recklessly.

Allegation 5.7: Paper 5 [Science 2004 May 14;304(5673):1010-4]. *The allegation that the protein bands in Fig. 3C was falsified.*

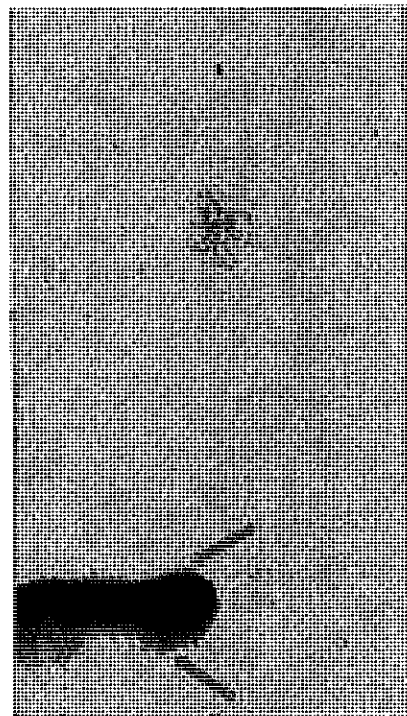
Dr. Sauer provided the RIO with the following digital images (**Appendix 8** – that the RIO provided to Calforensics) as being relevant to **Figure 3C**:

- nucleosomen H2B coomassie.psd, last modified 9/3/2003 9:24 AM;
- nucleosomen histone H2b kinase.psd, last modified 9/9/2003 10:15 PM; and
- 1095001fig3.eps, last modified 4/14/2004 7:55 AM.

Calforensics reviewed the digital images provided to the RIO by Dr. Sauer that he suggested were relevant to Figure 3C (**Appendix 8**). Calforensics observed that the two psd files contain the black bands on solid white backgrounds as in the final figure. Dr. Sauer provided the file nucleosomen histone H2b kinase.psd, last modified 9/9/2003 10:15 PM, which appears to contain the image represented in the bottom panel in the final figure.

nucleosomen histone H2b kinase.psd
9/3/2003 9:24 AM 9/9/2003 10:15 PM

nucleosomen histone H2b kinase.psd
9/3/2003 9:24 AM 9/9/2003 10:15 PM
(Further Adjusted in Photoshop)



After applying adjustments, Calforensics observed the artifacts noted by *Science*. Note the red arrows showing sharp edge to band as if this has been cut out with a selection tool. This can be seen more clearly in the right hand panel below. Therefore, although we do not have an original scan, Calforensics concluded that due to the indicia of alterations in the files provided by Dr. Sauer that experimental data for Figure 3C was manipulated.

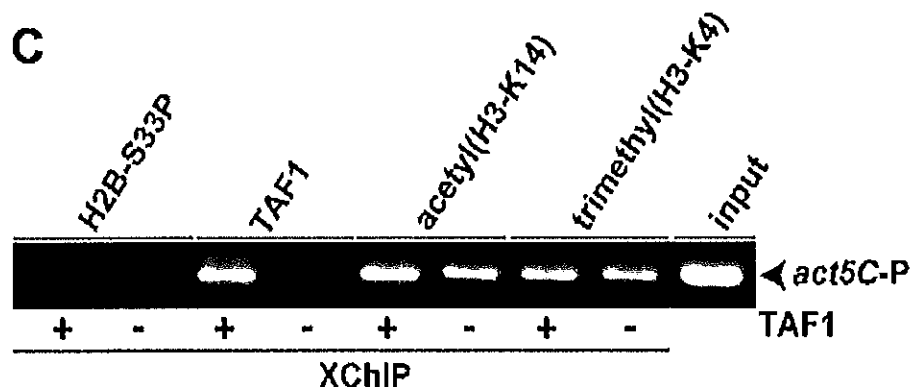
On 6/18/12 Dr. Sauer presented an Illustrator digital image Item 60 that he claimed was a copy of the original Coomassie Blue gel for paper 5, Fig. 3C. Item 52 (bottom panel which is the panel being questioned) was a very low resolution Illustrator digital image (of what appears to be a photocopy) so it was not possible to tell whether this image had been manipulated. Because these items were not provided to the RIO Dr. Louis, as requested on October 13, 2011, and therefore were not sequestered, there was no assurance that these figures were actually associated with these papers. Thus, the Committee was not persuaded that these materials supported Dr. Sauer's position.

Allegation 5.7: Investigation Committee Conclusions

The Committee concluded that Paper 5 Figure 3C had indicia of using a selection tool to select the band and make some sort of alteration to the gel image. Based upon a preponderance of the evidence, the Committee concludes this act is research misconduct because it constitutes data falsification. Further, such conduct represents a significant departure from the accepted practices of Dr. Sauer's research community, and this conduct was committed recklessly.

Allegation 5.9: Paper 5 [Science 2004 May 14;304(5673):1010-4]. The allegation that the protein bands in Fig. Supplement S5C was falsified.

Original Paper 5, Fig Supplement S5C submitted by Dr. Sauer to *Science*



Science identified Supplement Fig. S5 Panel C in Paper 5 as being comprised of spliced out bands that had been pasted into the image.

Appendix 7: *Science* communication 11/18/11: [1095001figS5_yf.pdf]

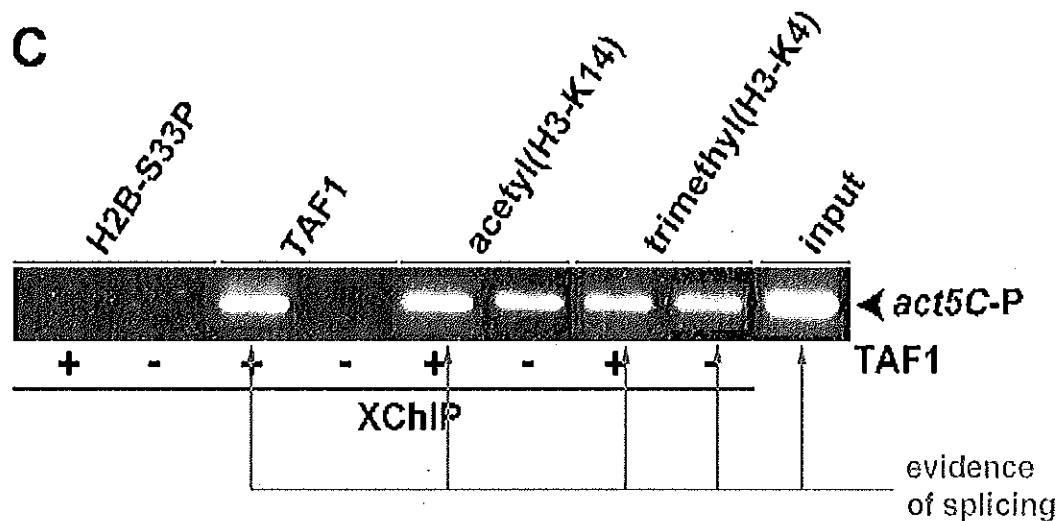
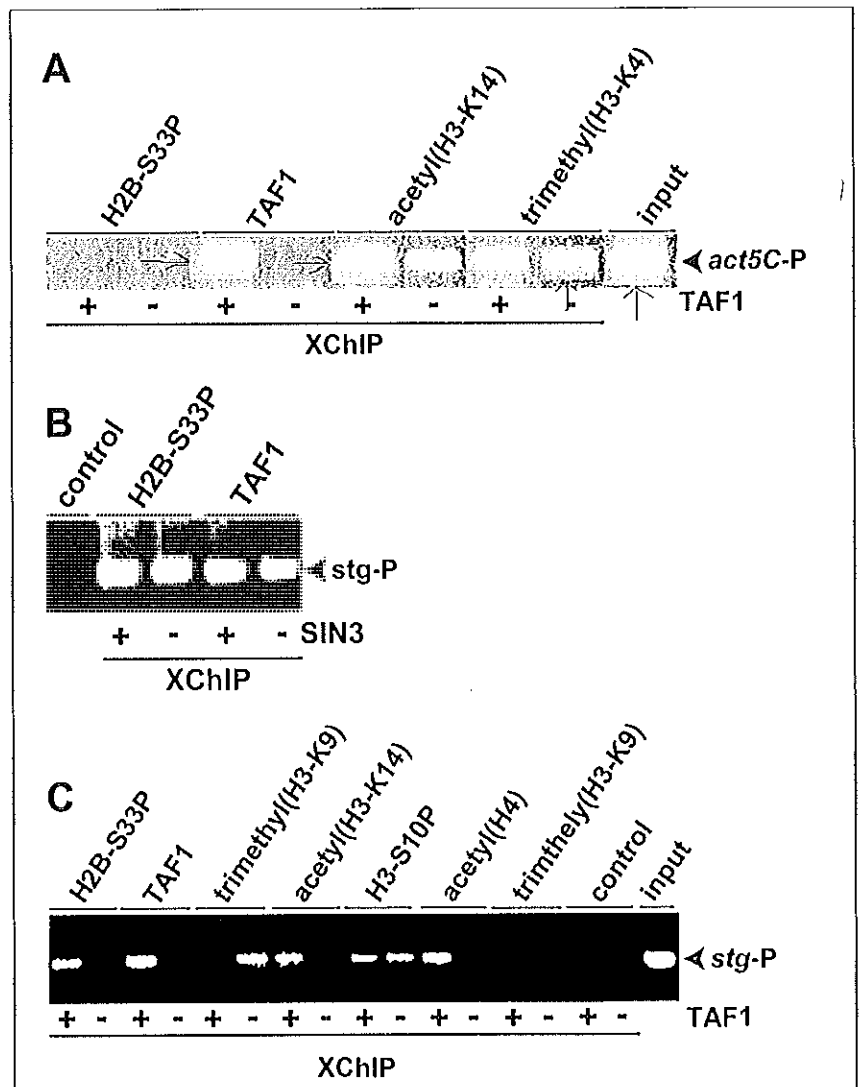
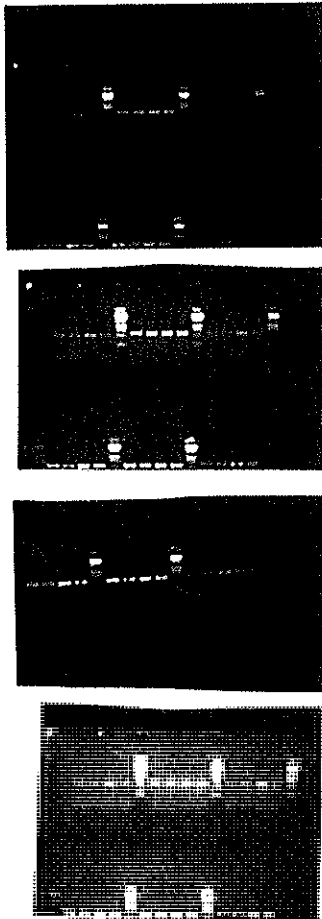


Figure S5

Dr. Sauer suggested one file as being relevant to **Figure S5C**: Frank-16.psd, last modified 11/18/2003 6:44 AM (**Appendix 9**). However, Calforensics identified an additional file on one of the disks provided by Dr. Sauer (**Appendix 8**) that appears to contain the images in the final Figure S5: 1095001Fig5s.eps, last modified 3/29/2004 4:27 PM.

Calforensics reviewed the file (Frank-16.psd, last modified 11/18/2003 6:44 AM) that Dr. Sauer suggested was relevant to Figure S5C and observed that it contains four separate scans (see below). They could not determine which scan may be the original scan for this figure. Calforensics reviewed the eps file 1095001Fig5s.eps, last modified 3/29/2004 4:27 PM. This file appears to contain the images for the Figures S5A, S5B and S5C. Although, the image represented in the final figure as S5C is represented as Figure S5A in this eps file. After adjustments, Calforensics observed the splicing artifacts observed by *Science* (see red arrows).



The Investigation Committee also observed the same clear appearance of rectangles around five of the six bands in the image of “boxed” Fig. S5C taken directly from the PDF of the online paper 5 Supplement when the contrast of the whole image was adjusted in Photoshop:

Fig. S5C from the online PDF



Furthermore the white dots visible to the left of the most left hand band in this Fig S5C (circled in red above) matches exactly the background in Fig 4B of Paper 5 (Allegation

6.1) indicating the same background was used in fabricating both images. Indeed there is significant similarity between this left most band in Fig S5C and the 2nd left most band in Fig 4B as they perfectly overlay each other when examined in Photoshop.

Therefore, although they were unable to identify the original scan, the Committee concluded that due to the indicia of splicing noted by *Science*, the eps file provided by Dr. Sauer, as well as the online Supplement PDF figure, that the experimental data for Paper 5 Figure S5C was falsified and fabricated.

Allegation 5.9: Investigation Committee Conclusions

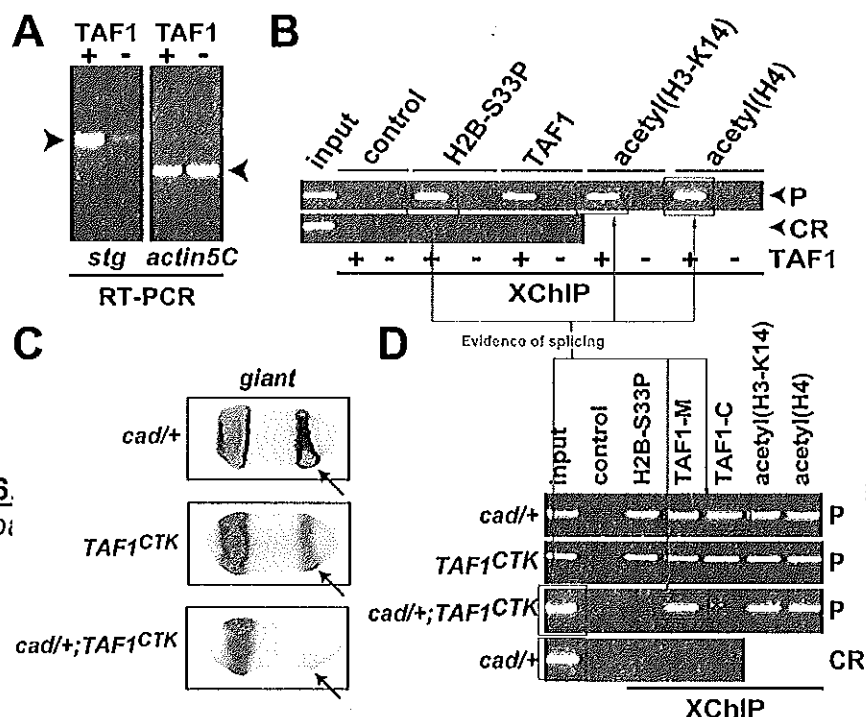
The Committee concluded that Paper 5 Figure S5C Panel A had indicia of using a selection tool to cut out bands and insert them on top of another gel to alter to the gel images. Based upon a preponderance of the evidence, the Committee concludes this act is research misconduct because it constitutes data falsification and fabrication. Further, such conduct represents a significant departure from the accepted practices of Dr. Sauer's research community, and by its nature it was committed intentionally and knowingly.

Allegation #6:

Paper 5 Science 2004 May 14;304(5673):1010-4 *We highly suspect that DNA bands in Figs. 4B and 4D were heavily manipulated. Due to our technical limitations, we do not know if these bands were pasted to the blot.*

Science observed that the very sharp appearance of the sections of gels containing the bands in Figures 4B and 4D in Paper 5 [Science 2004 May 14;304(5673):1010-4] suggested that bands may have been pasted/spliced to blots. These bands that were cut and pasted into the gel background were presented as single gels.

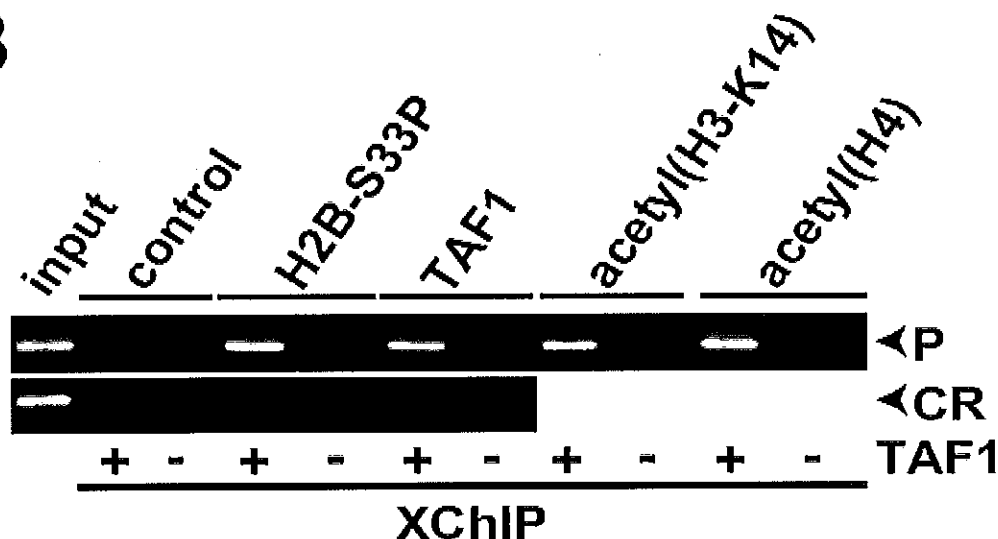
Science analysis of Fig 4 Paper 5 - Appendix 7 [1095001fig4_yf.pdf]



Allegation 6:
the protein bi

Allegation that

B



Dr. Dr. Sauer provided the RIO with the following digital images (Appendix 8 – that the RIO provided to Calforensics) as being relevant to Figure 4B:

- TAFRNAi-XChIP.psd, last modified 3/5/2004 8:32 PM;
- XChIP-TAF1-RNAi.psd, last modified 3/5/2004 8:33 PM;
- XChIP-cells.psd, last modified 3/7/2004 9:40 PM; and
- TAF1 RNAi-cells-final.psd, last modified 3/7/2004 9:45 PM.

Calforensics reviewed the hard drive forensic images they acquired from the sequestered computers and found no files relevant to this figure.

Calforensics reviewed the digital images provided to the RIO by Dr. Sauer (Appendix 8) as being relevant to Figure 4B and observed that all four files contain images with a white background with one layer containing the bands. Calforensics noted that they all appear to contain splicing and not just the artifacts noted by *Science*. In all four files, when levels are adjusted, every band appears as if it has been spliced into the resulting image (see below). Note the three white spots between lanes 1 and 2 in the top three images (middle spot circled in red); in the 4th (bottom) image the region with the three white spots has been replicated to the left of the three spots in the upper 3 files with the left hand band now shifted further to the left of these three white spots (compare analysis of TAF1 RNAi-cells-final.psd 3/7/2004 9:45 PM, IC31.1 with IC31.2); this file that Dr. Sauer said was relevant to Paper 5 Fig. 4B appears to be a trial gel image manipulation of this figure. Dr. Sauer did not provide a digital image of the original scan, and therefore, the Committee was unable to know how the banding in the original scan should appear. It is clear however, that the resulting figure was comprised of data that was spliced together.

TAFRNAI-XChIP.psd
3/5/2004 8:32 PM



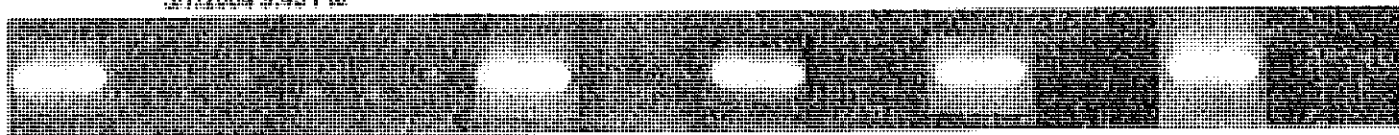
XChIP-TAF1-RNAi.psd
3/5/2004 8:33 PM



XChIP-cells.psd
3/7/2004 9:40 PM



TAF1 RNAi-cells-final.psd
3/7/2004 9:45 PM

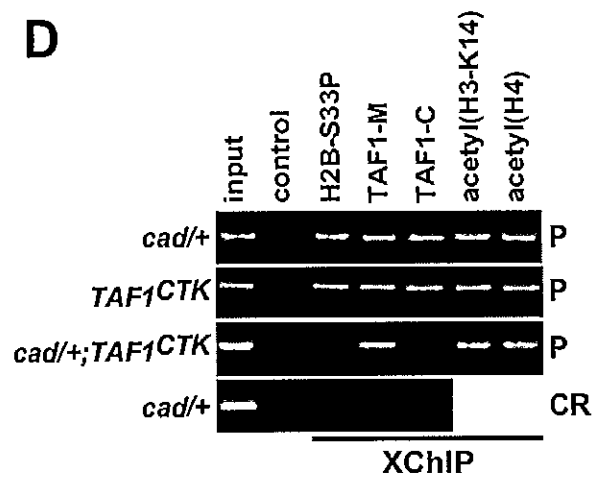


In further support of this conclusion, note that the analysis of Allegation 5.9 conducted by the Investigation Committee of Paper 5, Fig Fig S5C (top of p. 42) above and the lower panel in Allegation 6.2 below Fig 4D (see IC36 – IC36.2) also has this same pattern of white spots in the background of the gels – this is most clearly seen in the analysis conducted of Fig S5C by the Investigation Committee (top of p. 42). The Committee concluded that in all three cases the whole or part of the same background was used to paste bands onto and that this was therefore data falsification and fabrication.

Allegation 6.1: Investigation Committee Conclusions

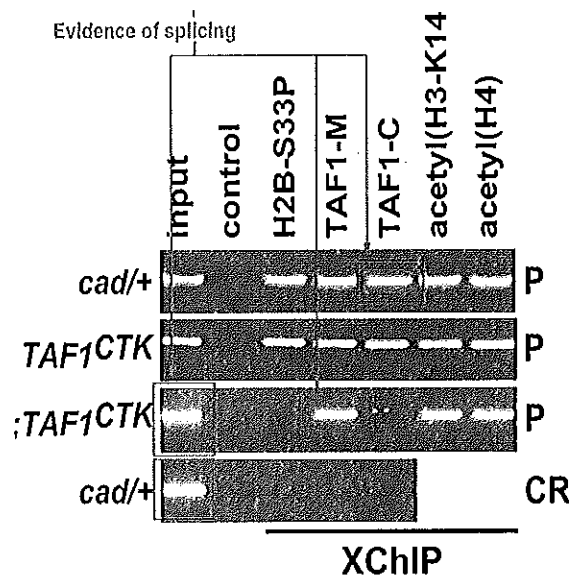
The Committee concludes that Paper 5 Figure 4B had indicia of using a selection tool to cut out bands and insert them on top of another gel to alter the gel images. Based upon a preponderance of the evidence, the Committee concludes this act is research misconduct because it constitutes data falsification and fabrication. Further, such conduct represents a significant departure from the accepted practices of Dr. Sauer's research community, and by its nature, it was committed intentionally and knowingly.

Allegation 6.2: *Paper 5 [Science 2004 May 14;304(5673):1010-4]. The allegation that the protein bands in Fig. 4D was falsified.*



Science (Appendix 7) found evidence of splicing. The images relevant to three of the four panels of this figure appear to contain data that was spliced together (top, 3rd and 4th panels).

Science analysis of Fig 4D - Appendix 7 [1095001fig4_vf.pdf]



Allegations regarding Paper 5, Fig 4D Top Panel:

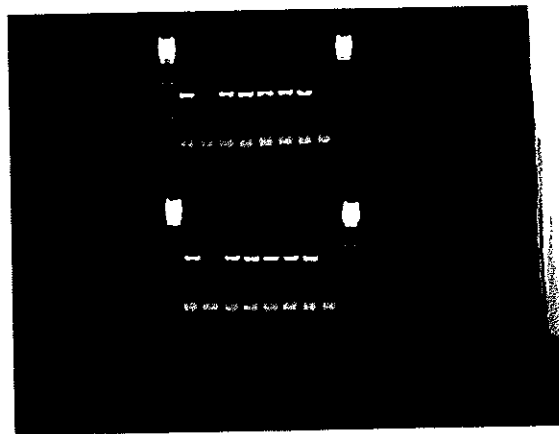
Dr. Sauer provided the RIO with the following digital images (Appendix 8 – that the RIO provided to Calforensics) as being relevant to Figure 4D:

- frank-2-DNA.psd, last modified 3/7/2004 3:16 PM;
- Frank-DNA-7.psd, last modified 3/7/2004 3:56 PM;
- cad-3194-final.psd, last modified 3/7/2004 4:06 PM;
- cad +-final.psd, last modified 3/7/2004 5:59 PM;
- cad-3194-final-2.psd, last modified 3/7/2004 6:08 PM;
- cad-3194-final-2 (2).psd, last modified 3/7/2004 6:08 PM;
- cad+ CR.psd, last modified 3/7/2004 10:56 PM.
- cad -+.final2.psd, last modified 3/27/2004 3:00 PM;
- cad-3194-final2, last modified 3/27/2004 3:04 PM; and
- cad_+TAF1CTK#D126.psd, last modified 4/20/2004 11:09 AM.

Calforensics reviewed the hard drive forensic images they acquired from the sequestered computers and found no files relevant to this figure.

Calforensics reviewed the digital images provided by Dr. Sauer as being relevant to Figure 4D and observed that the images relevant to three of the four panels of this figure appear to contain data that was spliced together. Dr. Sauer provided what appear to be psd files from two original scans that are relevant (Frank-DNA-7.psd, last modified 3/7/2004 3:56 PM and frank-2-DNA.psd, last modified 3/7/2004 3:16 PM.) Dr. Sauer did not provide an original scan representing the fourth and final panel of the figure.

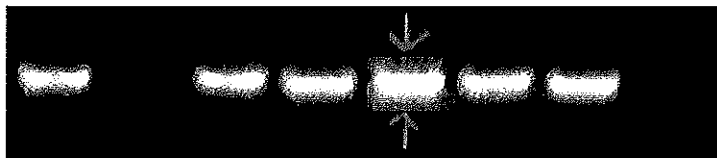
Frank-DNA-7.psd
3/7/2004 3:56 PM:



For the first panel, Dr. Sauer provided cad +-final.psd, last modified 3/7/2004 5:59 PM, which contains a background with the six bands and one layer containing just one band in the fourth position. Even in the background alone, with levels adjusted the splicing artifacts noted by *Science* around the fourth band are apparent. The band in the background looks slightly different than the band in the layer. This band in the layer appears to have been pasted over the fourth band in the background. It appears that the data in the original scan was used to comprise the background and then a different

band was pasted into the fourth position. The resulting image was then likely saved as cad -+.final2.psd, last modified 3/27/2004 3:00 PM and used to comprise the final figure.

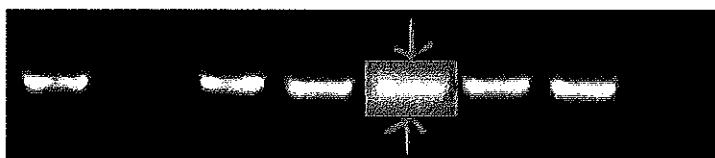
cad +-.final.psd (Background Only)
3/7/2004 5:59 PM



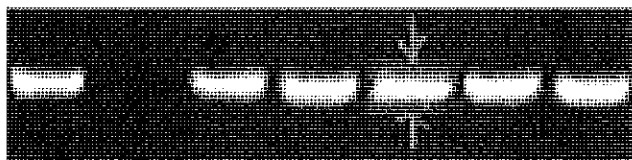
cad +-.final.psd (Layer Only)
3/7/2004 5:59 PM



cad +-.final.psd (Background and Layer)
3/7/2004 5:59 PM



cad -+.final2.psd
3/27/2004 3:00 PM



That this band in the 4th lane was a layer that could be removed in Photoshop makes clear that the band in this lane was cloned from another gel lane and inserted on this gel. The Committee concluded that Paper 5 Figure 4D, top panel had indicia of using a selection tool to cut out a band and insert it on top of another gel to alter the gel image. This is data falsification and fabrication.

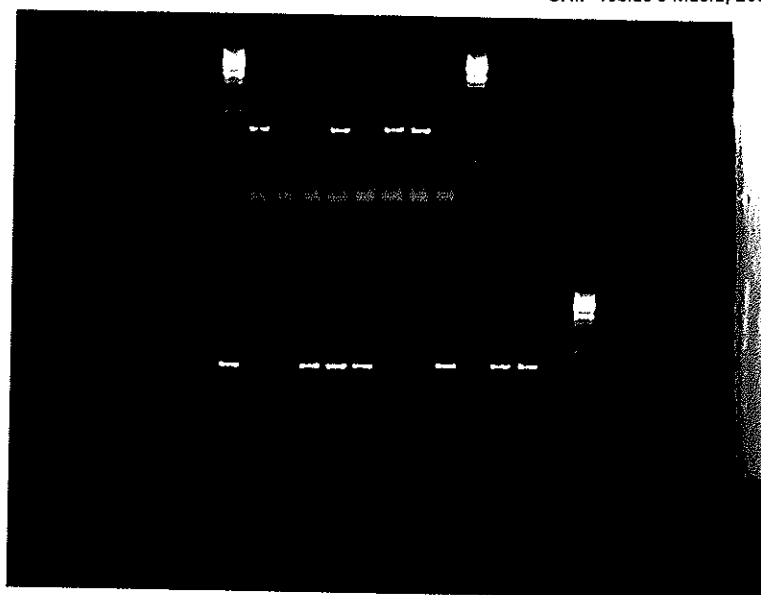
Allegation regarding Paper 5, Fig 4D Third Panel

For the third panel in Figure 4D, Dr. Sauer provided six relevant files. Calforensics reviewed these files and concluded it is possible that the file frank-2-DNA.psd, last modified 3/7/2004 3:16 PM, contains an image of the original scan. While the banding in this original scan appears similar to that of the third panel in the figure, Calforensics could not conclude that any of the bands in this original scan were used to comprise the

final figure. The resulting figure does appear to be comprised of an image that has at least one band (the first band) spliced into it.

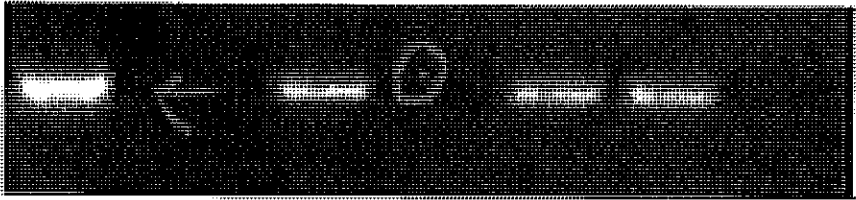
frank-2-DNA.psd
3/7/2004 3:16 PM

CHIP Tobias 3 Maerz, 2004

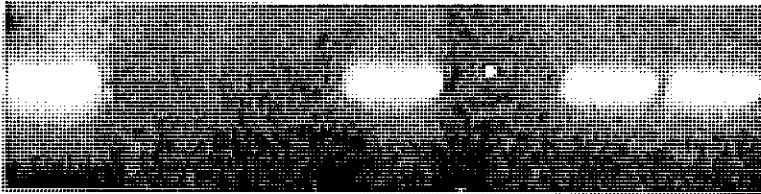


Dr. Sauer provided the file cad-3194-final.psd, last modified 3/7/2004 4:06 PM, which contains four bands on background only (no layers). When Calforensics adjusted the levels and contrast, the splicing artifacts of the first band (as noted by *Science*) appear (red arrow), but the alleged splicing artifacts at the second band does not appear. Upon adjustment and enlargement, this image also shows a sliver of white along the right edge. The presence of this white sliver suggests the image was copied from another file into this file but was not modified to cover the entire prior white background before the resulting image was flattened and saved. It appears that this white sliver was edited out in the file cad-3194-final2.psd, last modified 3/27/2004 3:04 PM, which contains a white background with a layer containing all four bands. Calforensics noted that when levels and contrast are adjusted, the splicing in the first band is slightly apparent and portions of the selection outline around the second band are apparent (red arrows). Similar to this file is the file cad_TAF1CTK#D126.psd, last modified 4/20/2004 11:09 AM, which contains all four bands on the background. When levels and contrast are adjusted, the splicing artifacts in the first band are slightly visible and the entire selection box around the second band is visible (red arrows). This image also contains other artifacts similar to those in cad-3194-final.psd, cad-3194-final2.psd and the resulting figure. The file cad_TAF1CTK#D126.psd is likely the image that was used to create the figure.

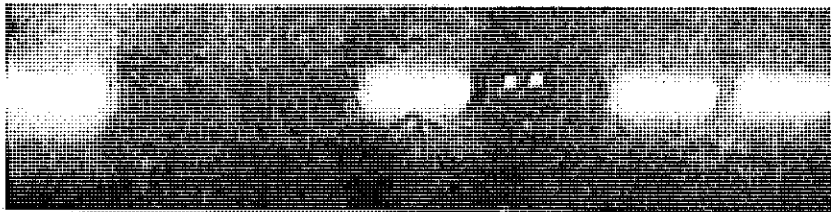
cad-3194-final.psd
3/7/2004 4:08 PM



cad-3194-final2
3/7/2004 3:04 PM



cad_TAF1CTK#D126.psd
4/20/2004 11:09 AM

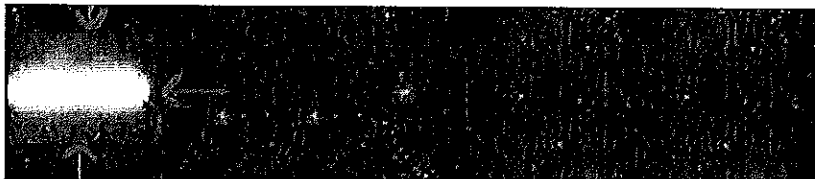


The Committee concluded that Paper 5 Figure 4D, third panel had indicia of using a selection tool to cut out bands and insert them on top of another gel to alter the gel image. This constitutes data fabrication.

Allegation regarding Paper 5, Fig 4D Bottom (4th) Panel

For the fourth panel, Dr. Sauer provided one relevant file: cad+ CR.psd, last modified 3/7/2004 10:56 PM, which contains the background with one band in it. Calforensics noted that when levels and contrast are adjusted, the splicing artifacts appear.

cad+ CR.psd
3/7/2004 10:56 PM



The Committee concluded that Paper 5 Figure 4D, 4th (bottom) panel had indicia of using a selection tool to cut out the band and insert it on top of another gel to alter the

gel image. Indeed, when compared to the image in Allegation 6.1 (IC31.1 and IC31.2) it is clear (based on the identity of the three background spots) that the file TAF1 RNAi-cells-final.psd 3/7/2004 9:45 PM that Dr. Sauer stated was relevant for Fig 4B was used to create this file cad+ CR.psd 3/7/2004 10:56 PM that was used to construct the 4th (bottom) panel in Fig 5D (compare IC36.1 with IC36.2). These same background spots are visible in Fig. S5C (Allegation 5.9). This constitutes three separate instances of research falsification and fabrication.

Allegation 6.2: Investigation Committee Conclusions

The Committee concluded that Paper 5 Figure 4D had indicia of using a selection tool to cut out bands and insert them on top of another gel to alter to the gel images in three of the four panels of this figure. Indeed, a portion of the lower panel in this figure has been used in Fig. 4B and Fig S5C based on the identity of background white spots in the gels. Based upon a preponderance of the evidence, the Committee concludes these acts are research misconduct because such acts constitute three separate instances of data falsification and fabrication. Further, such conduct represents a significant departure from the accepted practices of Dr. Sauer's research community, and by its nature it was committed intentionally and knowingly.

Allegation #7: Paper 6 Nature. 2002 Oct 24;419(6909):857-62. Coomassie Blue staining of H3, H2B, H2B and H4 bands of lanes 1 and 2 in Fig. 1b and those from lanes 2 and 3 in Fig. 2e are exactly the same and they are also the same from lanes 1 and 2 in Fig. 1B from a different paper (Science 2004 May 14;304 (5673):1010-4). These three experiments are completely different.

This is the same allegation as Allegation #4.

Allegation #7: Investigation Committee Conclusions

This is the same allegation as Allegation #4.

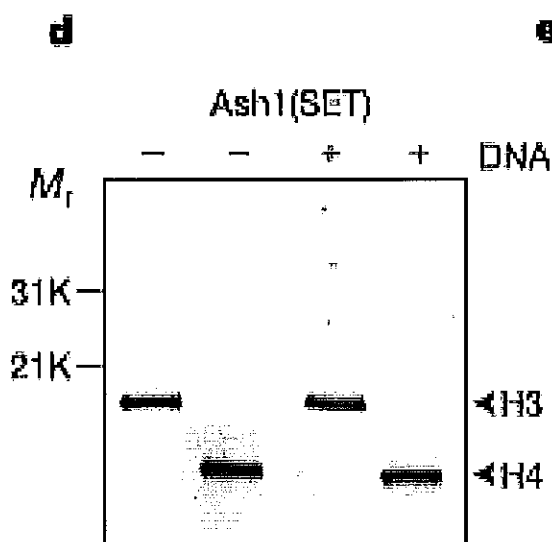
The Committee concludes that Paper 6 Figure 1b lanes 1 & 2 were replicated to produce Paper 5 Figure 1B lanes 3 & 4. The Committee concludes this is research misconduct because of data fabrication, it represents a significant departure from the accepted practices of Dr. Sauer's research community, and by its nature was committed intentionally, knowingly, and recklessly.

Allegation #8

Data fabrications in **Paper 6** *Nature*. 2002 Oct 24;419(6909):857-62. We highly suspect that protein bands in Figs. 1d, 2e, 2d, 4d, 4e, 4g were heavily manipulated. Due to our technical limitations, we do not know if these blots are falsified.

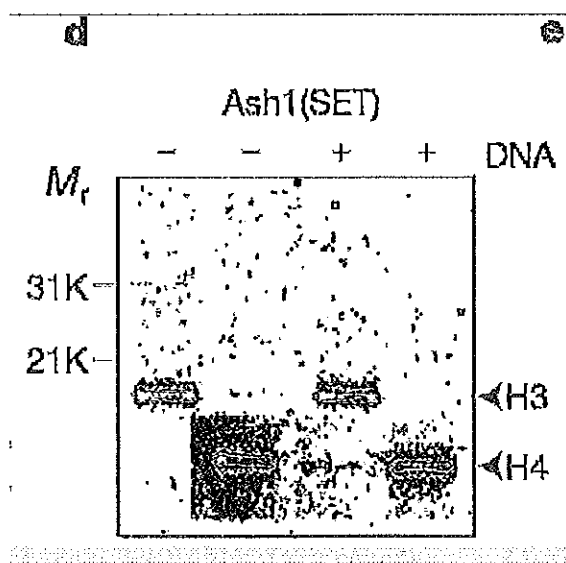
Allegation 8.1: We highly suspect that in Paper 6 (*Nature*. 2002) protein bands in Fig. 1d were heavily manipulated.

Original Figure 1d in Paper 6 extracted from the published *Nature* paper



Nature noted a block around the bands in image submitted by Dr. Sauer – an indicator that the bands have been either copied and pasted, or the contrast has been individually enhanced in some way.

Appendix 6: Image analyzed by *Nature*:

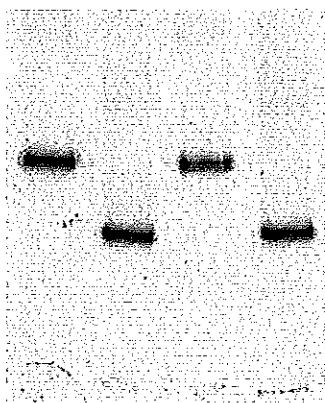


Dr. Sauer provided the RIO with the following digital images (Appendix 8 – that the RIO provided to Calforensics) as being relevant to Figure 1d:

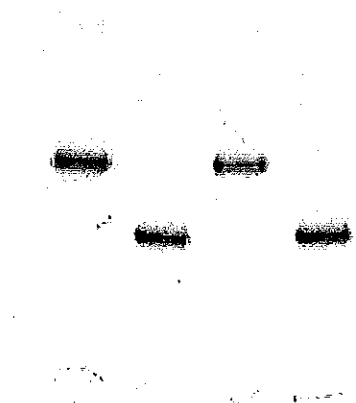
- DNA abhaengige HMT.psd, last modified 6/11/2002 11:23 PM;
- DNA abhaengige HMT (Film).psd, last modified 8/31/2002 3:06 AM; and
- Figure1-S12353A, last modified 9/12/2002 4:56 PM.

Calforensics reviewed the hard drive forensic images they acquired from the sequestered computers and did not recover files relevant to this figure.

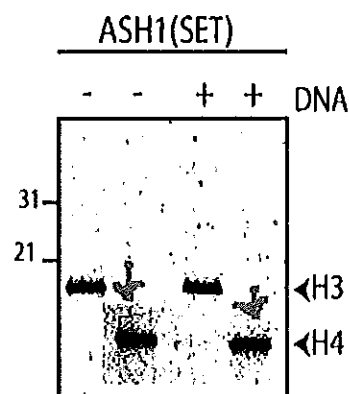
DNA abhaengige HMT.psd
6/11/2002 11:23 PM



DNA abhaengige H MT (Film).psd
8/31/2002 3:06 AM



d
Figure1-S12353A
9/12/2002 4:56 PM –
Panel d



Files provided by Dr. Sauer as being relevant to Fig 1d Paper 6

Calforensics noted that file Figure 1-S12353A which appears to be the file submitted to *Nature*, has blocks around the bands (red arrows). While those blocks do not appear in the two psd files that do not appear to have been manipulated, it is not clear that these two psd files were used to create the Adobe Illustrator file Figure 1-S12353A as the images don't match (especially bands in 1st and 3rd lanes). When the original Fig 1d image and Sauer file DNA abhaengige H MT (Film).psd are taken into Photoshop the two images do not superimpose; in contrast the two Sauer files DNA abhaengige H MT (Film).psd and DNA abhaengige HMT.psd 6/11/2002 11:23 PM do superimpose. Thus, based solely on the appearance of blocks around the bands in the figure submitted to *Nature* and file Figure1-S12353A that appears to be the figure submitted to *Nature* by Dr. Sauer, the data in this figure appears to have been manipulated.

On 6/18/12 Dr. Sauer presented Illustrator digital image Items 19 and 20 that he claimed were copies of the original file used in the final figure Fig. 1d. However, when the original Fig 1d image and Item 19 or 20 are taken into Photoshop the two images do not superimpose, indicating they are not the same experiment. Because these items were not provided to the RIO Dr. Louis, as requested on October 13, 2011, and

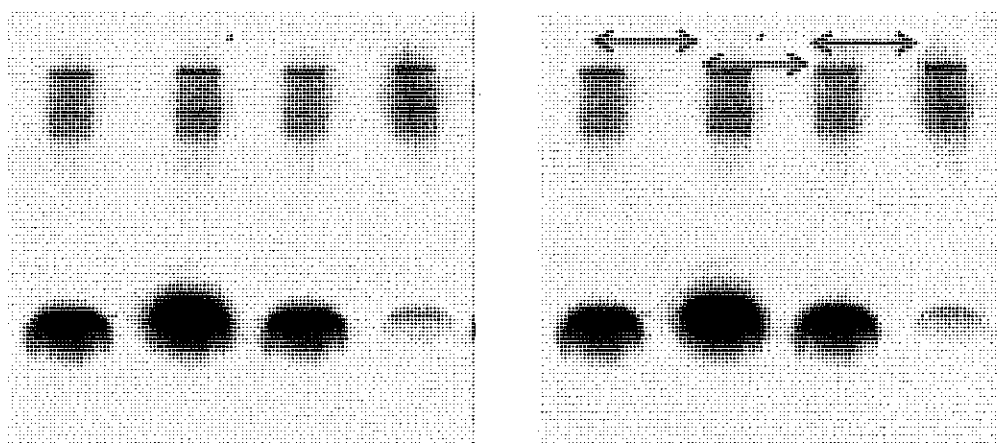
therefore were not sequestered, there was no assurance that these figures were actually associated with these papers. Thus, the Committee was not persuaded that these materials supported Dr. Sauer's position.

Allegation 8.1: Investigation Committee Conclusions

The Committee concurs with Nature and Calforensics that the protein bands in Paper 6 Fig. 1d were heavily manipulated. Based upon a preponderance of the evidence, the Committee concludes these acts are research misconduct because such acts constitute three separate instances of data falsification and fabrication. Further, such conduct represents a significant departure from the accepted practices of Dr. Sauer's research community, and by its nature it was committed intentionally and knowingly.

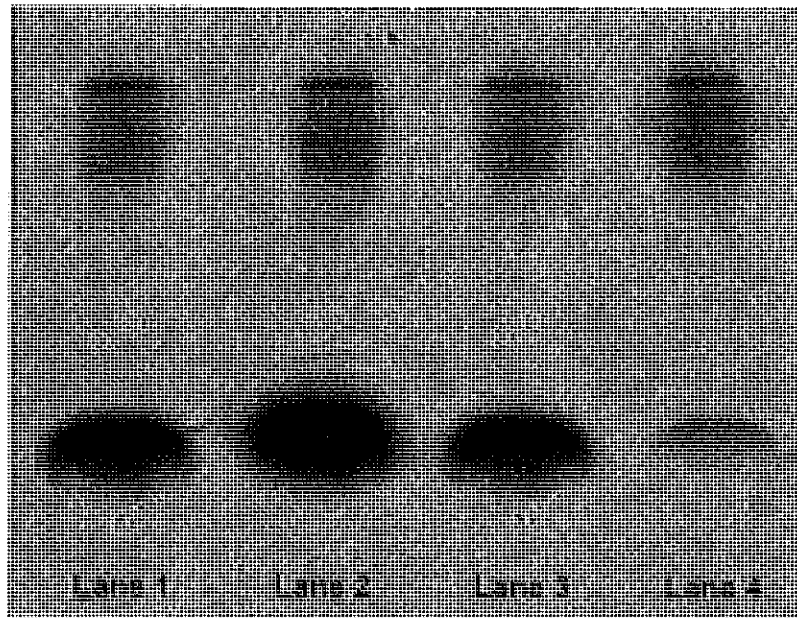
Allegation 8.2: *We highly suspect that in Paper 6 (Nature. 2002) Fig. 2b lane 1 is a duplicate copy of lane 3.*

Copy of Original Figure 2b from the Nature publication



Note that the spacing between lanes 2 and 3 is the same as spacing between lanes 3 and 4, but spacing between lanes 1 and 2 is considerably greater. When the images of lanes 1 and 3 are directly compared it can be seen that every marking of lane 3 is identical to the markings in lane 1 (compare IC16.3 with IC16.4).

IC16.5 [An image file provided by Dr. Sauer (**Appendix 9**) CD: Frank CD 4. File: Beisel et al 11-2001; File: final figures; File: Figure 2 (**Appendix 8**)].



When this image was analyzed in Photoshop there were background specs clearly visible in lanes 1 and 3 that when compared (IC16.5 versus 16.6) it is clear that these are identical gel images. Thus, Lane 1 is a clone of lane 3 and is a fabrication of data.

That lane 1 was “added” to the original experiment was confirmed in the interview with Dr. Sauer’s former graduate student _____ who stated that _____ had this figure in his thesis but only the three right hand lanes (p. 28 of _____ Transcript, **Appendix 15**), i.e. the first left hand lane was not part of the gel that _____ had produced and was presented in his Ph.D. thesis. When _____ saw this figure in the manuscript he told Dr. Sauer that he had only the three right lanes in his Ph.D. thesis and that “the gel is such as the last two lanes, two, three, and four, they originate from my Ph.D. thesis but they are mislabeled here”. His recollection is that Dr. Sauer had responded that “This is not so important here” (p. 29 of Beisel Transcript, **Appendix 15**).

Allegation 8.2: Investigation Committee Conclusions

The Committee concluded that the lane 1 in Paper 6 Fig. 2b was a clone of lane 3 and had been spliced into the gel. Based upon a preponderance of the evidence, the Committee concludes these acts are research misconduct because such acts constitute three separate instances of data falsification and fabrication. Further, such conduct represents a significant departure from the accepted practices of Dr. Sauer’s research community, and by its nature, it was committed intentionally and knowingly.

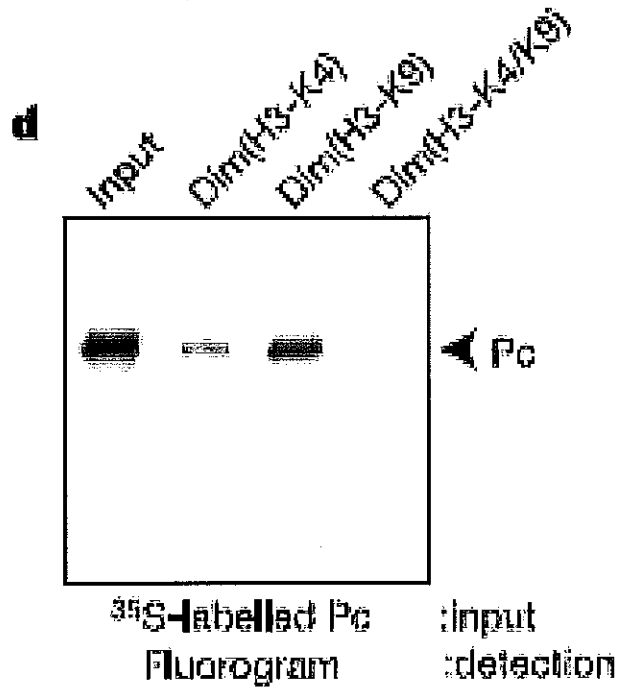
Allegation 8.3: *We highly suspect that in Paper 6 (Nature. 2002) protein bands in Fig. 2e were heavily manipulated.*

Allegation 8.3: Investigation Committee Conclusions

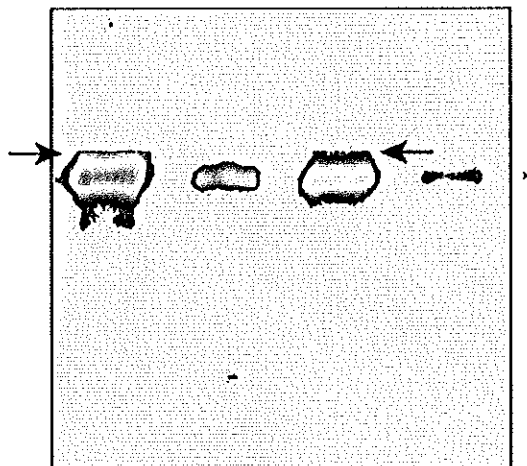
See also Allegation 4.2. Based upon a preponderance of the evidence, the Committee concludes this act is research misconduct because it constitutes data falsification and fabrication. Further, such conduct represents a significant departure from the accepted practices of Dr. Sauer's research community, and this conduct was committed recklessly.

Allegation 8.4: *We highly suspect that in Paper 6 (Nature, 2002) protein bands in Fig. 4d were heavily manipulated.*

Original Figure 4d, Paper 6 submitted by Dr. Sauer to Nature:



Appendix 6: Nature analysis:



In Figure 4d (with contrast-enhanced version), *Nature* noted a line just visible above the bands (see arrows), where cropping could have occurred.

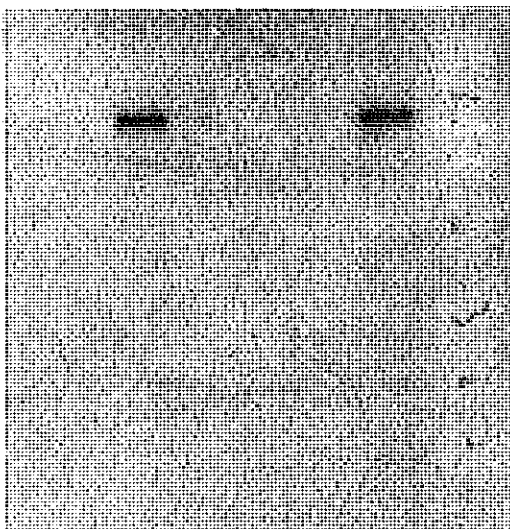
Dr. Sauer provided the RIO with the following digital images (**Appendix 8** – that the RIO provided to Calforensics) as being relevant to **Figure 4d**:

- H3-polycomb interaction 1.psd, last modified 5/3/2002 6:55 AM;
- H3-PC interaktion 2.psd, last modified 5/3/2002 7:01 AM; and
- p55-Interaction.tiff, last modified 8/30/2002 12:18 AM.

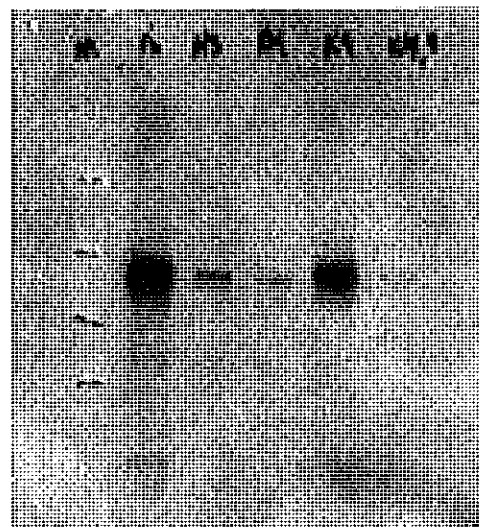
Calforensics reviewed the hard drive forensic images they acquired from the sequestered computers. No files relevant to this figure were recovered.

Calforensics reviewed the files that Dr. Sauer suggested were relevant to this figure. Upon first review of the files H3-polycomb interaction 1.psd, last modified 5/3/2002 6:55 AM and H3-PC interaktion 2.psd, last modified 5/3/2002 7:01 AM. Calforensics noted that the layout of the bands and the number of bands in these images are not the same as in the image in the resulting figure so did not appear to be relevant. Calforensics observed that it is possible that while of the bands in these two images may have been used to create the final figure, the image files would have had to have been significantly manipulated with gel lanes excised and rearranged in a final figure.

H3-polycomb interaction 1.psd
5/3/2002 6:55 AM



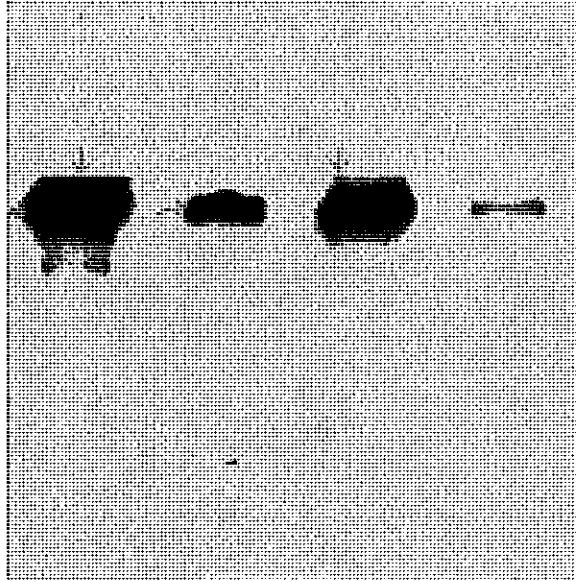
H3-PC interaktion 2.psd
5/3/2002 7:01 AM



Review by Calforensics of the file p55-Interaction.tiff, last modified 8/30/2002 12:18 AM, revealed that when levels and contrast are adjusted, the artifacts reported by *Nature* appear. Calforensics concluded that these artifacts are indicia of splicing. It appears as

if a selection tool had been crudely used in one image to grab the bands along with some pixels from the background and copy and paste the bands into p55-Interaction.tiff.

p55-Interaction.tiff 8/30/2002 12:18 AM



As shown in their enlarged and enhanced image above, the top section of two of the bands includes a perfectly straight white line that appears to be the result of using a straight edged selection tool to copy and paste the bands. This image is likely the image that comprises the resulting figure.

On 6/18/12 Dr. Sauer presented Item 37 (**Appendix 23**) that he claimed was a copy of the original file/image used in the final figure Fig. 4d. This was hard to assess as the file provided by Dr. Sauer for this image was of low resolution so it could not be determined whether or not it indeed was the experiment shown in Fig 4d. It was not associated with a specific experiment conducted on a specific date and recorded in a notebook of the scientist who conducted the experiment, so its provenance was unclear. Because these items were not provided to the RIO Dr. Louis, as requested on October 13, 2011, and therefore were not sequestered, there was no assurance that these figures were actually associated with these papers. Finally it should be noted that Item 37 was a secondary Illustrator file and not an original image file so its originality could not be confirmed. Thus the Committee was not persuaded that these materials supported Dr. Sauer's position. They concluded that this was a fabricated image.

Allegation 8.4: Investigation Committee Conclusions

The Committee concluded that the bands in Paper 6 Fig. 4d had been manipulated and cut using an imaging tool and then pasted into another gel. Based upon a preponderance of the evidence, the Committee concludes this act is research misconduct because it constitutes data fabrication. Further, such conduct represents a

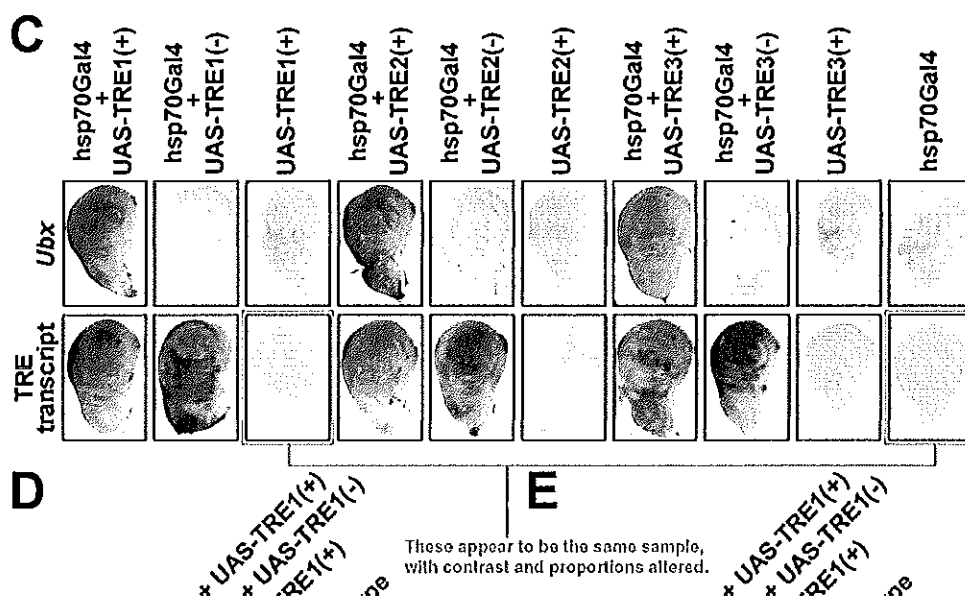
significant departure from the accepted practices of Dr. Sauer's research community, and this conduct was committed recklessly.

Allegation #9

Data fabrications in **Paper 7 Science. 2006 Feb 24;311(5764):1118-23.**

Larva staining by in situ hybridization in the lower 3rd panel (UAS-TRE1(+)) and the 10th panel (Hsp70Gal4) in Fig. 6C are exactly the same except some contrast adjustment. However, they were supposed to be two completely different larvae.

Science communication 11/18/11: [1117705 Fig6 yf 2 of 2.pdf]



Science concluded that Dr. Sauer fabricated data Figure 6C in the **Science Paper 7**. Specifically, the larva staining by in situ hybridization in the lower 3rd panel [UAS-TRE(+)] and the 10th panel (HSP70Gal4) in Figure 6C are exactly the same except for some contrast adjustment. However, they were supposed to be completely different larvae; indeed all larval images are reported in the paper as being derived from separate and unique experiments. (**Science Appendix 7**).

Dr. Sauer provided the RIO with the following digital images (**Appendix 8** – that the RIO provided to Calforensics) as being relevant to **Figure 6C**. Those that appear to be relevant to the two panels in question are the following:

- 1117705-Fig-6.eps, last modified 10/2/2005 11:48 AM;
- hsp70Gal4 TRE RNA.psd, last modified 10/2/2005 1:30 PM; and
- UAS-TRE1(+)-TRE-RNA.psd, last modified 10/4/2005 1:51 PM.

Californsics reviewed the hard drive forensic images they acquired and found on the Sauer laptop one relevant file, 1117705-Fig-6.eps, last modified 8/22/2006 10:09 AM (found in file path User/fus/Desktop/Frank

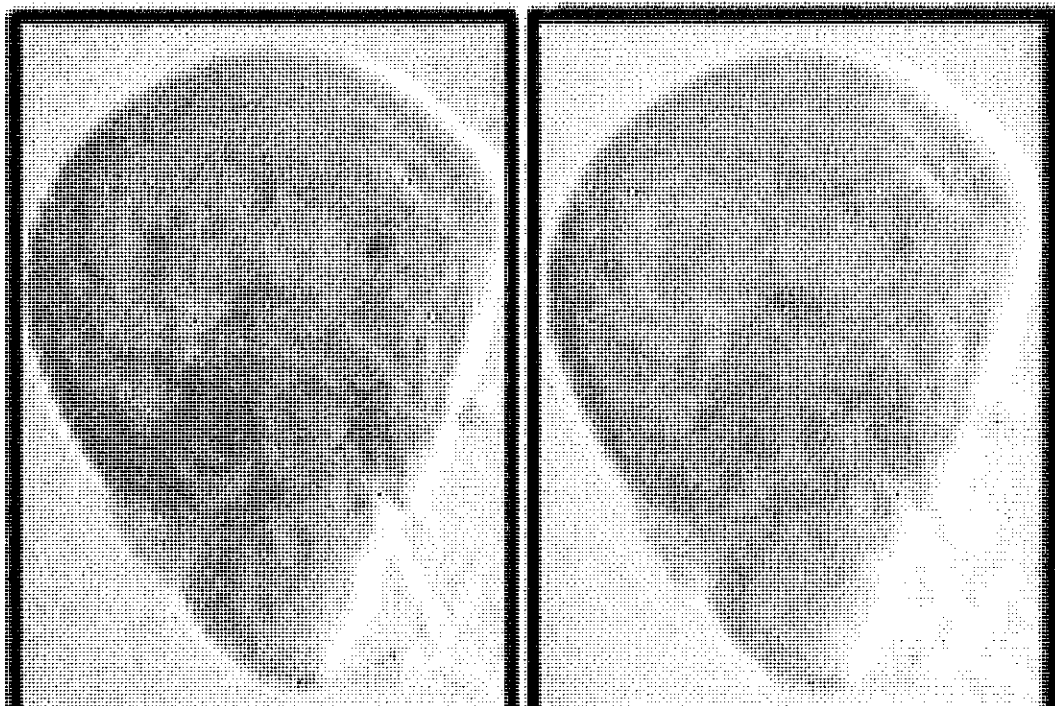
Calforensics reviewed hsp70Gal4 TRE RNA.psd, last modified 10/2/2005 1:30 PM, which appears to correspond to lower panel 10 and UAS-TRE1(+)-TRE-RNA.psd, last modified 10/4/2005 1:51 PM, which appears to correspond to lower panel 3.

Each image has a different hash value or digital fingerprint, meaning that the code making up each image differs in some way.

Calforensics reviewed Figure 6C in the image file 1117705-Fig-6.eps, last modified 8/22/2006 10:09 AM, found on the Sauer laptop and compared lower panel 3 to lower panel 10. Calforensics observed approximately 12 shared characteristics between the two images. They also reviewed the file 1117705-Fig-6.eps, last modified 10/2/2005 11:48 AM, suggested by Dr. Sauer to be the file he submitted to *Science*. In this file Calforensics observed the same shared characteristics between the images in panel 3 and panel 10. The illustration below is the result of adjusting each image to similar contrast, size and levels, and noting the points of similarity between the two images.

Panel 3

Panel 10



This finding that the same larval image is used in the bottom row panels larva 3 and 10 was confirmed where there are approximately 12 shared characteristics between the two lava stains in lower panels 3 and 10 of Figure 6C in Paper 7 that appear to be the same larva. That the images of these two panels had to be adjusted to have similar contrast, size and levels indicated that one of these images had been manipulated to make it appear each larval image was unique and distinct from all other larva in this figure.

When the Committee interviewed Dr. Sauer he acknowledged that these were the very same larva images and had been an honest error. This contradicts the interview with [redacted] who stated that [redacted] gave Dr. Sauer multiple experimental duplicates of each larva staining experiments, from which Dr. Sauer selected the image that [redacted] used in the final figure for publication (**Appendix 15** p. 30 – 31). Furthermore, Calforensics had to adjust the contrast, size and the extent of their being stretched in the x and y dimensions to get their images to be matched to demonstrate the identity of these two panels – their identity was not immediately apparent when examining the figure panels in the submitted figures.

Allegation #9: Investigation Committee Conclusions

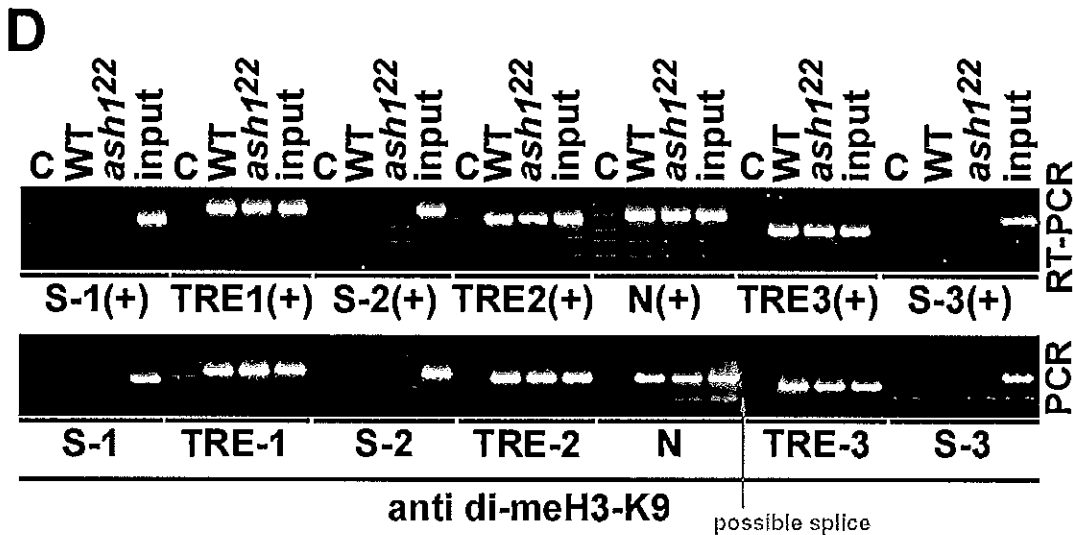
The Committee concluded there is replication of the same image in Panel C (bottom row panels 3 and 10). At least one of the images in these two panels had to have been significantly altered digitally in terms of its contrast, size, level and the extent of it being stretched in the x and y dimensions to get the two images to be matched. At least one of these images had been manipulated to make it appear that the two larval images were unique and distinct from all other larva in this figure. This was done intentionally which represents falsification of data as the same experimental data (larva) are reported as being derived from different experiments. Based upon a preponderance of the evidence, the Committee concludes this act is research misconduct because it constitutes data falsification. Further, such conduct represents a significant departure from the accepted practices of Dr. Sauer's research community, and by its nature it was committed intentionally and knowingly.

Allegation #10

Paper 7 Science. 2006 Feb 24;311(5764):1118-23.

The PCR bands in electrophoresis gel of the entire paper were very suspicious. If you adjust the contrast/brightness of the blots, the immediate surroundings of these bands are very distinct from the ambient background. However, due to our technical limitations, we could not say conclusively that these blots are falsified.

Allegation 10.1: *That gel bands were spliced into the lower panel of Fig. 4D in Paper 7.*

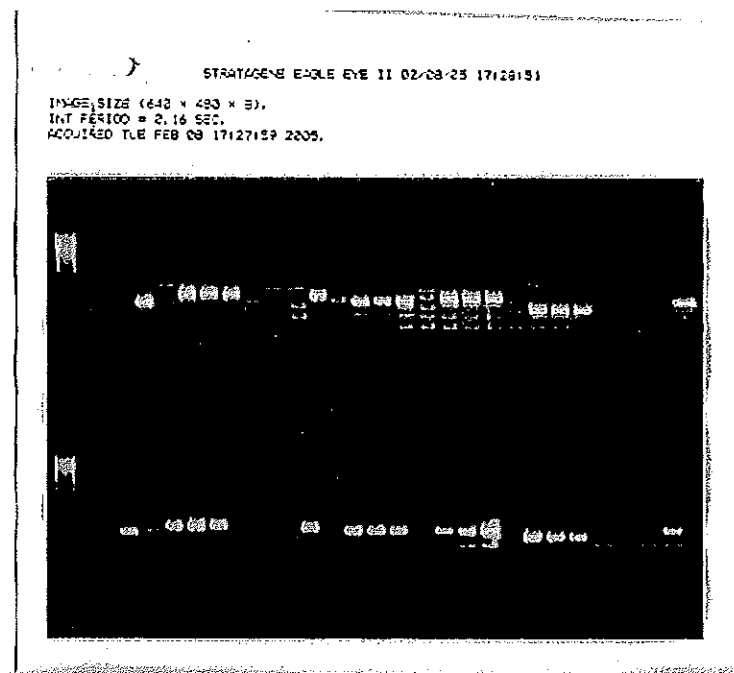


Dr. Sauer provided the RIO with the following digital images (Appendix 8 – that the RIO provided to Calforensics) as being relevant to Figure 4D:

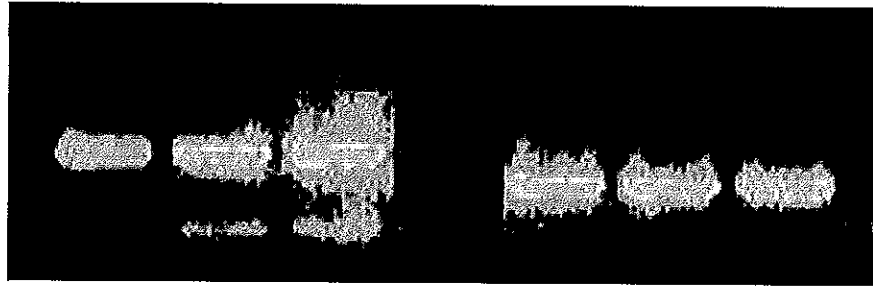
- 1117705-Fig-4.eps, last modified 9/12/2005 9:11 AM;
- Fig. 4D.psd, last modified 10/1/2005 5:42 PM; and
- Fig. Fig 4D.psd, last modified 10/1/2005 10:38 PM.

Calforensics reviewed the hard drive forensic images and observed the file 1117705-Fig-4.eps, last modified 9/12/2005 9:11 AM on the Sauer LHD. Calforensics reviewed the files provided by Dr. Sauer and suggested to be relevant to Figure 4D. The file Fig. 4D.psd, last modified 10/1/2005 5:42 PM, contains four scans, one of which was acquired on 2/8/2005 5:27 PM and appears to contain the same data as in the final figure. Dr. Sauer also provided Fig. Fig 4D.psd, last modified 10/1/2005 10:38 PM, which contains just the scan acquired on 2/8/2005 5:27 PM.

Fig. Fig 4D.psd
10/1/2005 10:38 PM

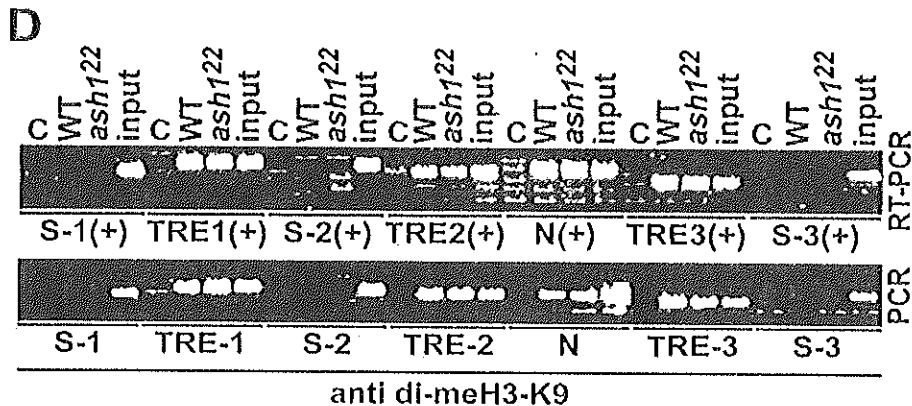


Lower gel Lanes Enlargement
Fig. Fig 4D.psd
10/1/2005 10:38 PM



When the lower gel lanes are enlarged in the file [Fig. Fig 4D.psd](#) 10/1/2005 10:38 PM, there is clear evidence of splicing of bands into this figure as indicated by the sharp edges to the bands (red arrows).

Panel D in
1117705-Fig-4.eps
9/12/2005 9:11 AM



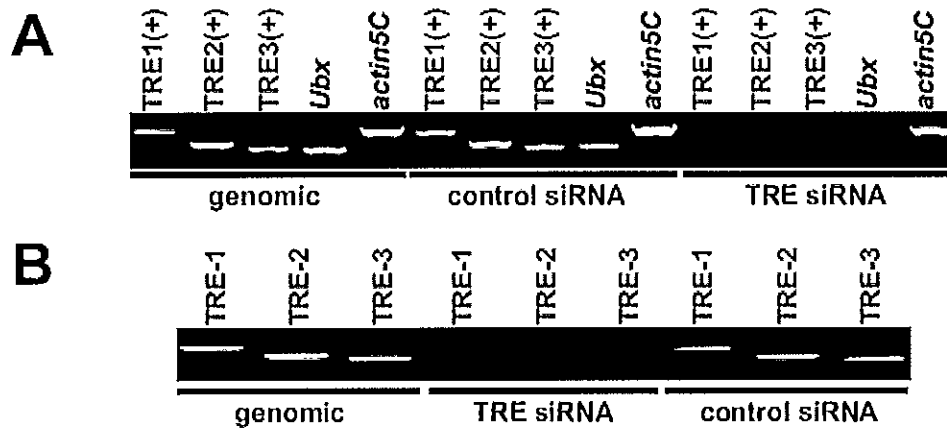
Califorensics also located file [1117705-Fig-4.eps](#), last modified 9/12/2005 9:11 AM as one of the hard drive forensic images acquired by from one of Dr. Sauer's sequestered computers, which also appears as if it may be the eps file that was used to create the final Figures 4A, 4B, 4C and 4D.

When Califorensics adjusted levels in all three of the files provided by Dr. Sauer they observed the artifacts as noted by *Science*. These artifacts are indicia of splicing or indicia of selecting the bands and making adjustments to the selected bands.

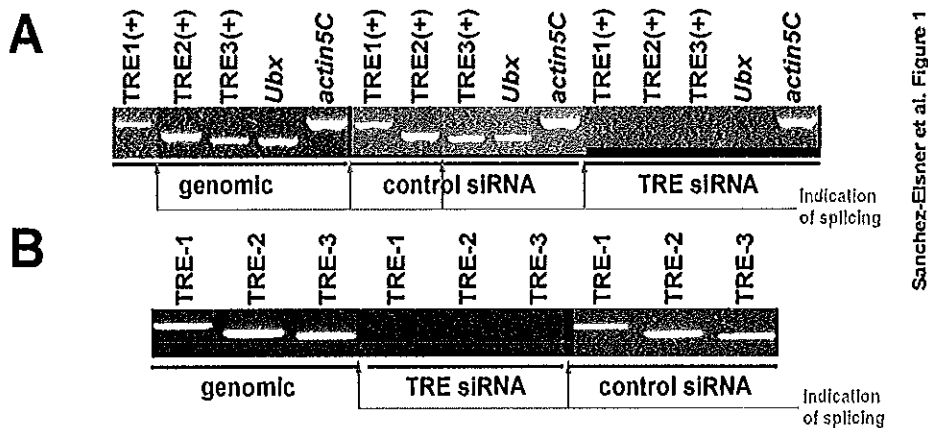
Allegation 10.1: Investigation Committee Conclusions

The Committee concluded that gel bands were spliced into the lower panel of Fig. 4D in Paper 7. Based upon a preponderance of the evidence, the Committee concludes this act is research misconduct because it constitutes data falsification. Further, such conduct represents a significant departure from the accepted practices of Dr. Sauer's research community, and this conduct was committed recklessly.

Allegation 10.2: *That different gels have been spliced together in creating Fig. 6A in Paper 7.*



Science communication (Appendix 7) 11/18/11: [1117705 Fig6_yf_1 of 2.pdf]



Based on the figure submitted by Dr. Sauer, *Science* noted that different gels appeared to be spliced together to create this figure which was presented as if it were a single unmodified gel in both Fig 6A and 6B.

Dr. Sauer provided the RIO with the following digital images (Appendix 8 – that the RIO provided to Calforensics) as being relevant to **Figure 6A**:

- Figure 6A.psd, last modified 10/2/2005 12:48 PM;
- Genomic(Si-RT-PCR).psd, last modified 9/11/2005 9:46 PM
- Si-control(Si-RT-PCR).psd, last modified 9/11/2005 9:45 PM
- Si-vs-TRE(Si-RT-PCR).psd, last modified 9/11/2005 9:47 PM
- Genomic (Si-RT-PCR)A.psd, last modified 9/11/2005 9:53 PM; and
- 1117705-Fig-6.eps last modified 10/2/2005 11:35 AM.

Califorensics reviewed the hard drive forensic images they acquired from the sequestered computers and observed on the Sauer Lab Scan Mac in the path "Users/sauerlabscanmac/Desktop/User Folders/Tilman/SiRNAon Third leg" the following files relevant to this figure:

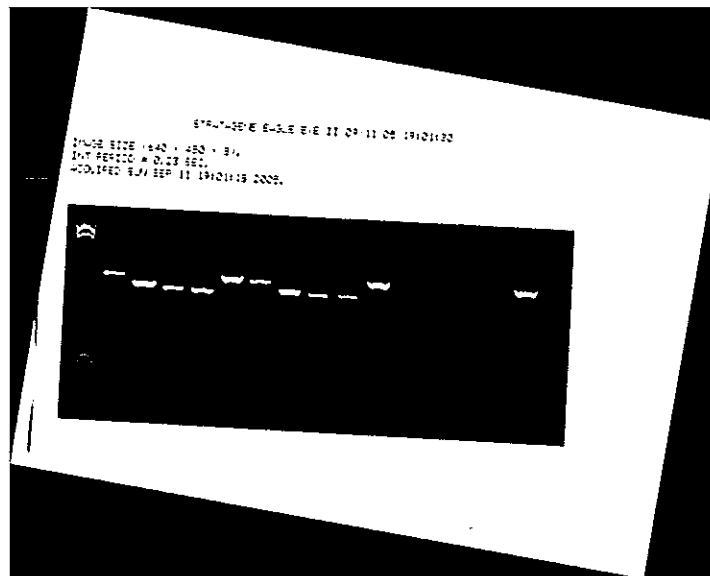
- Genomic(Si-RT-PCR).psd, last modified 9/11/2005 7:44 PM;
- Si-control(Si-RT-PCR).psd, last modified 9/11/2005 7:50 PM; and
- Si-vs-TRE(Si-RT-PCR).psd, last modified 9/11/2005 7:48 PM.

Califorensics also observed on the Sauer Lab Scan Mac in the path "Users/sauerlabscanmac/Desktop/User Folders/Tilman" the following relevant files:

- App0019.tif, last modified 9/11/2005 7:34 PM;
- App0020.tif, last modified 9/11/2005 7:44 PM;
- App0021.tif, last modified 9/11/2005 7:46 PM; and
- App0022.tif, last modified 9/11/2005 7:50 PM.

Califorensics reviewed the files provided by Dr. Sauer that he suggested were relevant to Figure 6A. The file Figure 6A.psd, last modified 10/2/2005, contains a scan acquired on 9/11/2005 7:01 PM. Califorensics observed that all 11 bands as represented in the final Figure 6A appear to be present in this scan. Adjusting brightness/contrast and/or levels did not reveal the alleged splicing artifacts for this iteration of the scan.

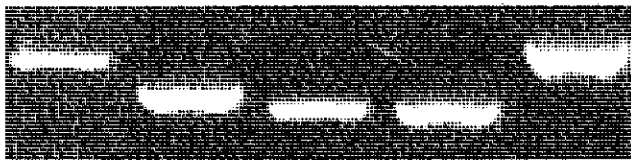
Fig. 6A.psd 10/2/2005 12:48 PM



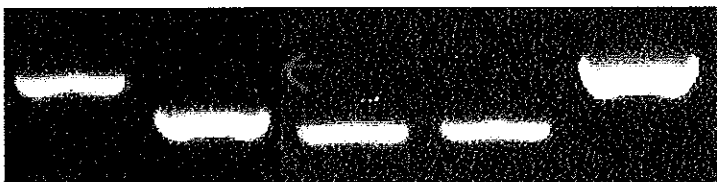
It appears, however, that the 11 bands in this scan were later cut into three sections (genomic, control siRNA and TRE siRNA) and spliced back together in the final figure. In addition to the psd of the scan, Dr. Sauer provided three psd files, each containing component bands of the 11 band figure (i.e. one file contains the genomic bands, one file contains the control siRNA bands, and one file contains the TRE siRNA bands).

These files are the Genomic(Si-RT-PCR).psd, last modified 9/11/2005 9:46 PM, Si-control(Si-RT-PCR).psd, last modified 9/11/2005 9:45 PM and Si-vs-TRE(Si-RT-PCR).psd, last modified 9/11/2005 9:47 PM, respectively. The fourth psd file named Genomic (Si-RT-PCR)A.psd, last modified 9:53 PM appears to be the three components combined to show all 11 bands.

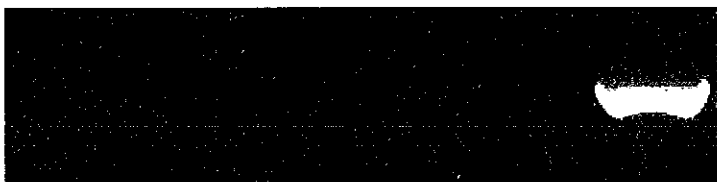
Genomic(Si-RT-PCR).psd (From Dr. Sauer)
9/11/2005 9:46 PM



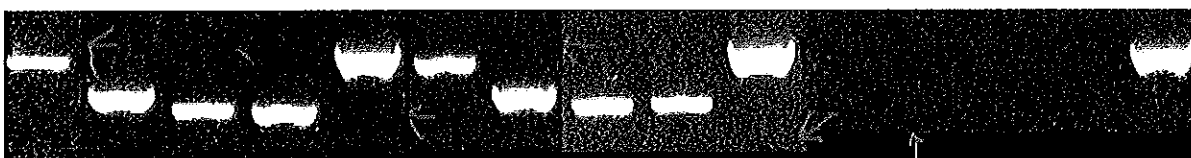
Si-control(Si-RT-PCR).psd (From Dr. Sauer)
9/11/2005 9:45 PM



Si-vs-TRE(Si-RT-PCR).psd (From Dr. Sauer)
9/11/2005 9:47 PM



Genomic (Si-RT-PCR)A.psd 9/11/2005 9:53 PM



In addition to observing what appear to be the artifacts of the three sections being spliced together, Calforensics also observe the artifacts after the first band in the genomic section and the second band in the control section as observed by *Science* [red arrows in file Genomic (Si-RT-PCR)A.psd 9/11/2005 9:53 PM].

Calforensics located on the Sauer Lab Scan Mac several psd files with the same file names as those provided by Dr. Sauer representing the three component parts of the figure (Genomic, control siRNA and TRE siRNA). These files appear to be earlier

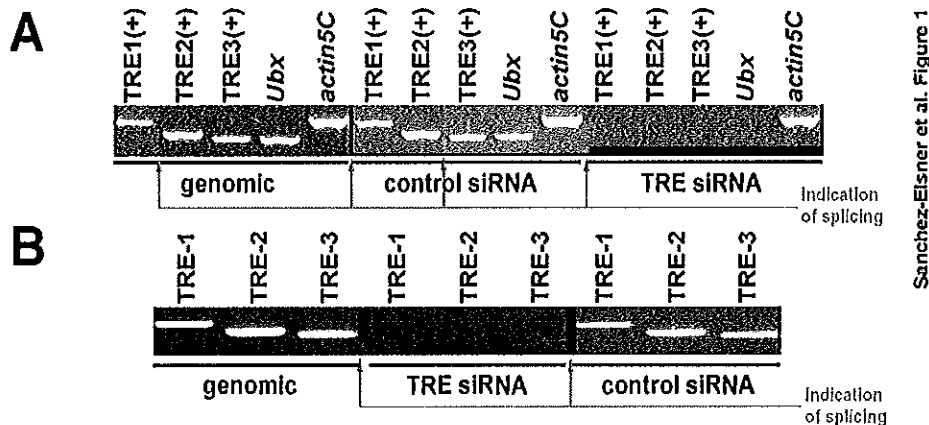
versions of the images in that they were last modified earlier than the psd files with same names provided by Dr. Sauer. Additionally, Calforensics observed on the Sauer Lab Scan Mac four tif files containing the component parts, some of which were last modified even earlier than the psd files. These files observed on the Sauer Lab Scan Mac do not appear to contain the additional artifacts after the first band in the Genomic section and the second band in the control section. The bands do, however, appear to be the same as those in the files provided by Dr. Sauer. While it is not clear if the first band in the Genomic section and the first and second band in the control section were spliced in from a different scan, it is clear that data were spliced together.

Allegation 10.2: Investigation Committee Conclusions

The Committee concluded that gel lanes in the original data for Fig 6A in Paper 7 were spliced out, separate files created, the images were modified in Photoshop, and then reassembled into the final figure without indicating that the gel lanes had been spliced out and reassembled. The final Figure 6A was made to appear as if it was an unaltered gel as there were no white or black bands between the spliced sections which is a misrepresentation and contrary to the publication policies of *Science* and *Nature* (Appendix 17). Based upon a preponderance of the evidence, the Committee concludes this act is research misconduct because it constitutes data falsification. Further, such conduct represents a significant departure from the accepted practices of Dr. Sauer's research community, and this conduct represents recklessness in the manipulation of images that were to be used in the submitted manuscript.

Allegation 10.3: *That different gels have been spliced together in creating Fig. 6B in Paper 7.*

Science communication (Appendix 7) 11/18/11: [1117705 Fig6 yf 1 of 2.pdf]



Based on the figure submitted by Dr. Sauer, *Science* noted that different gels appeared to be spliced together to create this figure which was presented as if it were a single unmodified gel in both Fig 6A and 6B.

Dr. Sauer provided the RIO with the following digital images (**Appendix 8** – that the RIO provided to Calforensics) as being relevant to **Figure 6B**:

- Fig. 6B-c.psd, last modified 9/30/2005 2:48 PM;
- Genomic (Si-ChIP).psd, last modified 9/11/2005 9:58 PM;
- Genomic (Si-ChIP)A.psd, last modified 9/11/2005 9:58 PM;
- Si-Control(Si-ChIP).psd, last modified 9/11/2005 9:58 PM;
- Fig. 6B.psd, last modified 10/2/2005 2:05 PM; and
- 10_2_05_3#6FE2.jpg, last modified 10/2/2005 2:05 PM.

Calforensics reviewed the hard drive forensic images they acquired from the sequestered computers and observed the following on the Sauer Lab Scan Mac in the path "Users/sauerlabscanmac/Desktop/User Folders/Tilman/SiRNAon Third leg" the following relevant files:

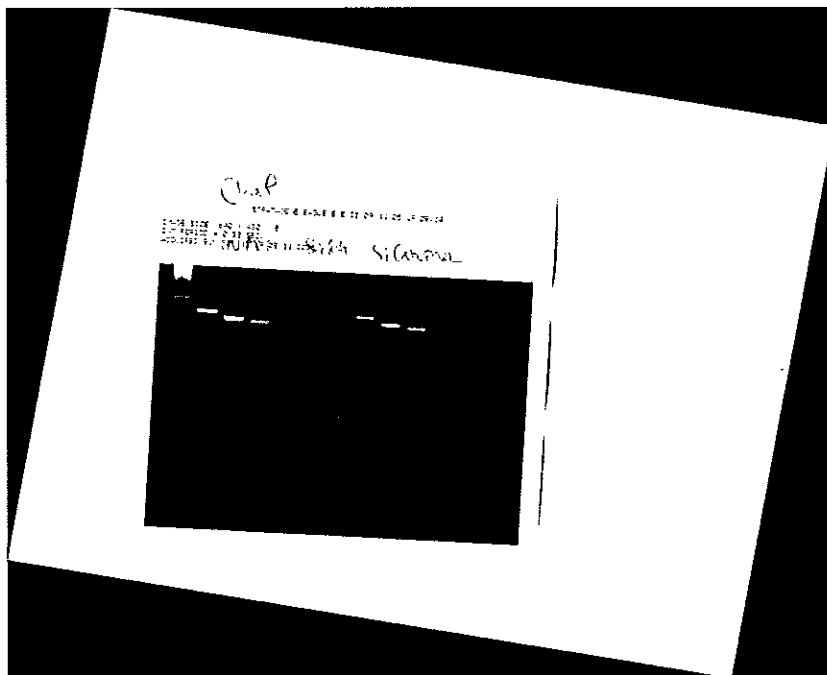
- Genomic (Si-ChIP).psd, last modified 9/11/2005 7:54 PM
- Si-Control(Si-ChIP).psd, last modified 9/11/2005 7:59 PM; and
- Si-vs-TRE(Si-ChIP).psd, last modified 9/11/2005 7:55 PM.

Calforensics also observed on the Sauer Lab Scan Mac in the path "Users/sauerlabscanmac/Desktop/User Folders/Tilman" the following relevant files:

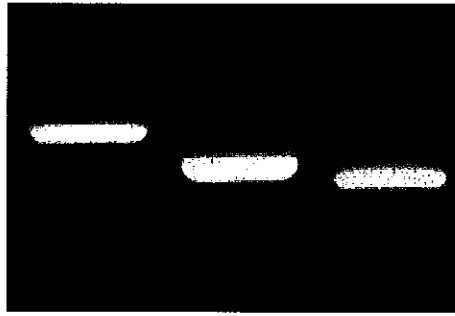
- App0023.tif, last modified 9/11/2005 7:55 PM; and
- App0024.tif, last modified 9/11/2005 8:00 PM;

Similar to Figure 6A, it appears the original scan (shown in files Fig. 6B-c.psd, last modified 9/30/2005 2:48 PM; Fig. 6B.psd, last modified 10/2/2005 2:05 PM; and 10_2_05_3#6FE2.jpg, last modified 10/2/2005 2:05 PM) was broken up into three parts (shown in various psd and tif files) and pieced back together in a new psd file. Calforensics observed the splicing artifacts indicating the three parts were spliced together.

Fig. 6B.psd (From Dr. Sauer)
10/2/2005 2:05 PM



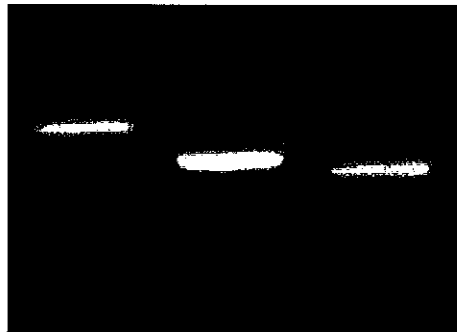
Genomic(Si-ChIP).psd (From Sauer Lab Scan Mac)
9/11/2005 7:54 PM



Si-vs-TRE(Si-ChIP).psd (From Sauer Lab Scan Mac)
9/11/2005 7:55 PM



Si-Control(Si-ChIP).psd (From Sauer Lab Scan Mac)
9/11/2005 7:59 PM



Genomic (Si-ChIP).psd (From Dr. Sauer)
9/11/2005 9:58 PM



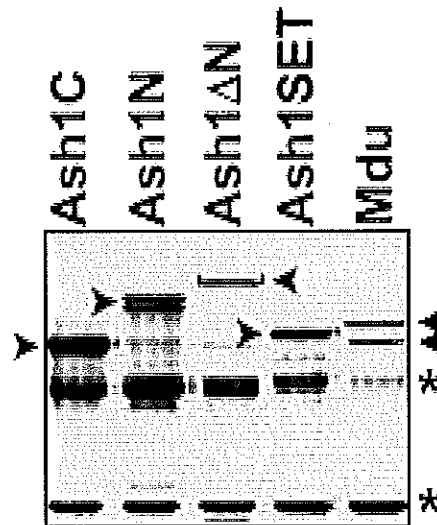
Allegation 10.3: Investigation Committee Conclusions

The Committee concluded that gel lanes in the original data for Fig 6B in Paper 7 were spliced out, separate files created, the images were modified in Photoshop, and then

reassembled into the final figure without indicating that the gel lanes had been spliced out and reassembled. The final Figure 6B was made to appear as if it was an unaltered gel as there were no white or black bands between the spliced sections which is a misrepresentation and contrary to the publication policies of *Science* and *Nature* (Appendix 17). Based upon a preponderance of the evidence, the Committee concludes these acts are research misconduct because it constitutes data falsification. Further, such conduct represents a significant departure from the accepted practices of Dr. Sauer's research community, and this conduct represents recklessness in the manipulation of images that were to be used in the submitted manuscript.

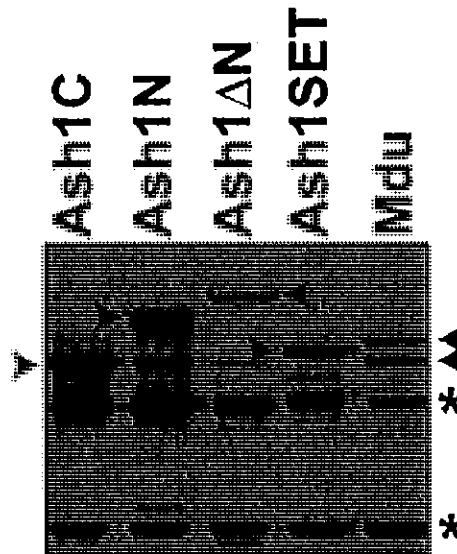
Allegation 10.5: That different gels have been spliced together in creating Fig. S5A in Paper 7.

Paper 7, Fig S5A submitted by Dr. Sauer for publication in *Science*



Science identified significant pixilation and image artifacts such as visible here which are expected with low-resolution figures. However, there are some sharp demarcations in panel A that raise suspicion (Appendix 7).

Science communication (Appendix 7) 11/18/11: [1117705 FigS56_yf.pdf]



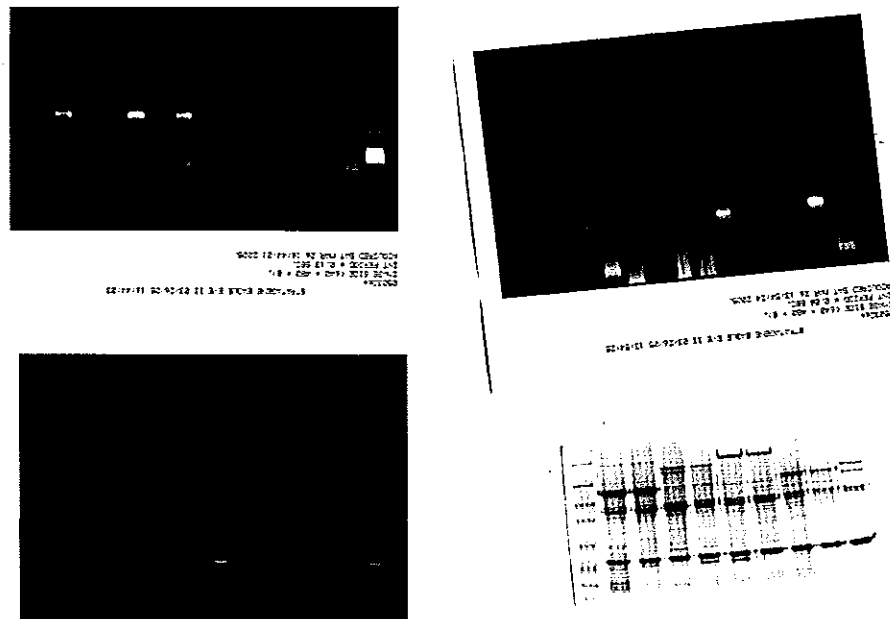
Dr. Sauer identified several files as being relevant to **Figure S5A** in **Appendix 9** that were not found on the 12 CDs he provided on 11/17/12 (**Appendix 8**). **Appendix 8** did contain the following files which were relevant to this figure:

- hp_ScanDS_5721753759.psd, last modified 7/2/2005 4:19 PM;
- hp_ScanDS_5721751Fed5313.psd, last modified 7/2/2005 4:24 PM; and
- Ash1-proteine-2.psd, last modified 7/3/2005 12:40 AM.

Califorensics reviewed the hard drive forensic images they acquired from the sequestered computers and did not recover files relevant to this figure.

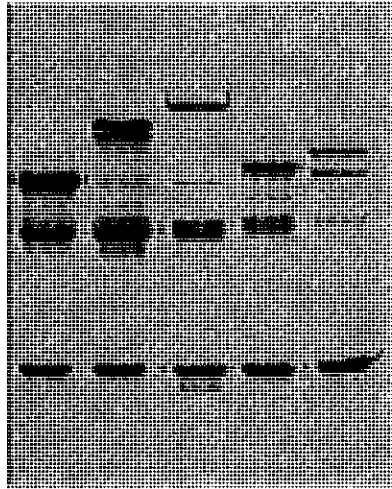
Dr. Sauer provided the file hp_ScanDS_5721753759.psd, last modified 7/2/2005 4:19 PM, which appears to be a copy of the original scan and hp_ScanDS_57217515313.psd, last modified 7/2/2005 4:24 PM, which appears to reflect the same original scan.

Hp_scanDS_5721753759
7/2/2005 4:19 PM (See lower right scan.)



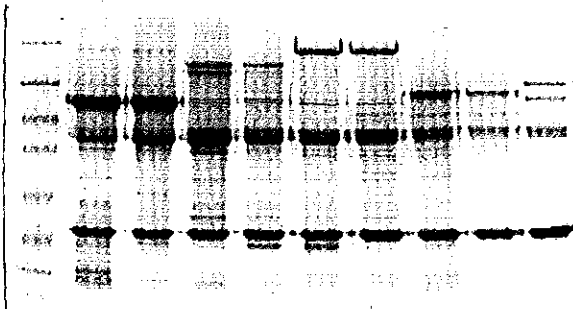
Dr. Sauer also provided Ash1-proteine-2.psd, last modified 7/3/2005 12:40 AM. When levels and contrast are adjusted for the image Ash1-protene2.psd the pixilation and artifacts are visible. However, the pixilation and artifacts appear similar to the apparent image of the original scan.

Ash1-proteine-2.psd
7/3/2005 12:40 AM



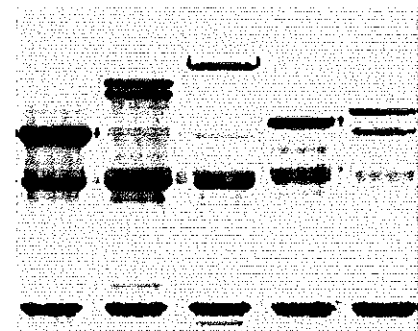
A notable difference between the latter image and the original scan, however, is that the latter image does not contain all of the lanes from the original scan. The latter image appears to contain only lanes 2 (or possibly 3), 4, 6, 8 and 10 of the 10 lanes in the original scan. Thus, Calforensics' analysis of the underlying image establishes that these lanes would have had to have been spliced together to create the resulting image, but there is no obvious evidence of splicing in the resulting image file Ash1-proteine-2.psd, last modified 7/3/2005 12:40 AM.

Hp_scanDS_5721753759
7/2/2005 4:19 PM



Lanes: 1 2 3 4 5 6 7 8 9 10

Original Fig S5A Submitted to Science by Dr. Sauer.



Lanes: 2 4 6 8 10
(from adjacent image)

While there is a superficial similarity between lanes 2, 4, 6, 8, and 10 in these two images, on careful analysis lanes 2 and 10 do not seem identical in the two images which would indicate lanes were spliced in from another unknown Coomassie gel. What is clear is that gel lanes have been spliced together for the final figure that does not appear to have been all derived from the file Hp_scanDS_5721753759 7/2/2005 4:19 PM.

Allegation 10.5: Investigation Committee Conclusions

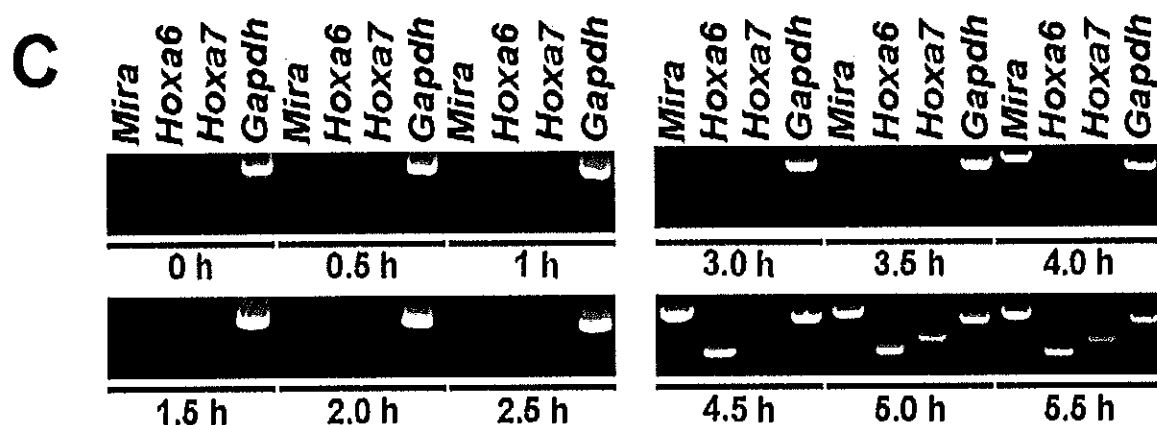
The Committee concluded that gel lanes in the original data for Fig S5A in Paper 7 were spliced out, separate files created, the images were modified in Photoshop, and then reassembled into the final figure without indicating that the gel lanes had been spliced out and reassembled. Even though this was a partially reconstituted figure there is no obvious evidence nor mention by the authors of splicing in the resulting image file Ash1-proteine-2.psd, last modified 7/3/2005 12:40 AM which may have been the final image used for the creation of Fig S5A by Dr. Sauer. The final Figure S5A was made to appear as if it was an unaltered gel as there were no white or black bands between the spliced sections which is a misrepresentation and contrary to the publication policies of *Science* and *Nature* (**Appendix 17**). Furthermore, this figure may have been assembled from more than one original Coomassie gel because of the issues with lanes 2 and 10. Based upon a preponderance of the evidence, the Committee concludes these acts are research misconduct because they constitute data falsification and fabrication. Further, such conduct represents a significant departure from the accepted practices of Dr. Sauer's research community, and this conduct represents recklessness in the manipulation of images that were to be used in the submitted manuscript.

Allegation #12: Data fabrications in *Paper 8 Mol Cell. 2011 Sep 16;43(6):1040-6.*

The PCR bands in electrophoresis gel of supplementary Fig. S1C are very suspicious. If you adjust the contrast/brightness of the blots, the immediate surroundings of these bands are very distinct from the ambient background. However, due to our technical limitations, we could not say conclusively that these blots are falsified.

The Committee had noted that the PCR bands in electrophoresis gel of Figure S1C in the paper *Molecular Cell. 2011 Sep 16;43(6):1040-6* are very suspicious. Specifically, it was observed that adjusting the contrast/brightness of the blots makes the immediate surroundings of these bands very distinct from the ambient background.

Paper 8, Fig. S1C submitted by Dr. Sauer for publication in *Molecular Cell*



Dr. Sauer indicated several files that were located in the Paper in Progress folder on the Computer laptop Sauer2 that were relevant to Figure S1C. The files are named as follows:

- timing2.jpg;
- timing2.psd;
- timing-2.ai;
- timing2-B.psd;
- timing-2-B-2.psd;
- timing-new-3.psd (converted to timing-new-3.psd);
- timing-new-3.psd; and
- timing-new-3.psd in timing.ai

Califorensics searched the hard drive images and observed most of the aforementioned files on the Sauer laptop as well as some on the Gel Imaging Station and the Big Mac. They identified and reviewed the following files:

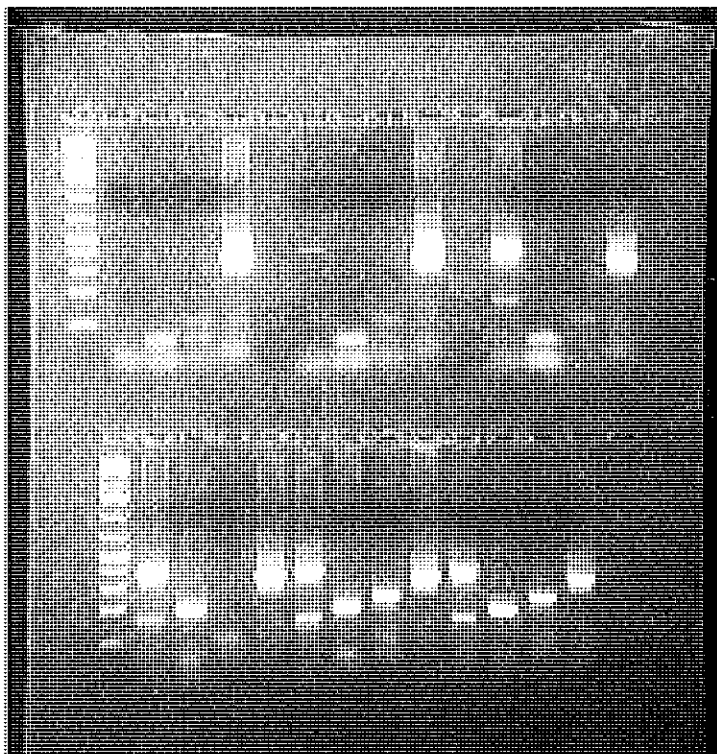
- timing2.bip, last modified 1/21/2010 9:34 AM (from Gel Imaging Station);
- timing2.jpg, last modified 1/21/2010 10:47 AM (from Gel Imaging Station);
- timing2.jpg, last modified 1/21/2010 10:47 AM (from the Sauer laptop);
- timing2.jpg, last modified 1/21/2010 10:47 AM (from the Big Mac);
- timing2.psd, last modified 4/30/2010 11:41 AM (from the Sauer laptop);
- timing2-B.psd, last modified 4/30/2010 12:22 PM (from the Sauer laptop);
- timing-2.ai, last modified 5/2/2010 9:59 PM (from the Sauer laptop);
- timing-2-B-2.psd, last modified 6/29/2010 5:31 PM (from the Sauer laptop); and
- timing--new-3.psd, last modified 8/10/2010 9:15 PM (from the Sauer laptop).

These files appear to be relevant to the lower right panel of Figure S1C.

Additionally, Califorensics reviewed in Adobe Photoshop the final figure contained in the pdf paper.

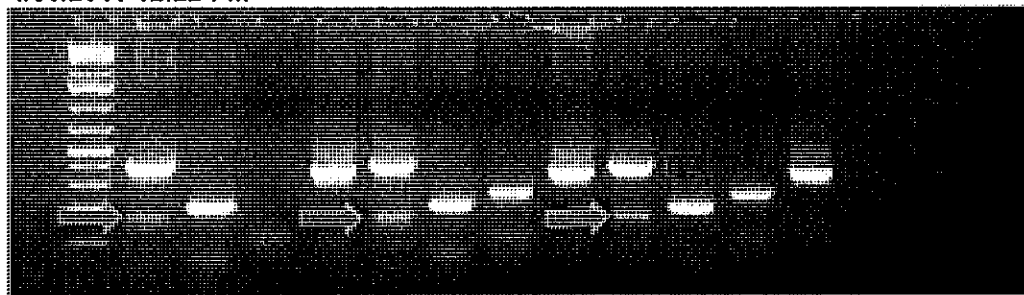
Califorensics first reviewed the figure in the Paper 8 pdf and observed the distinct surroundings of the bands as noted by *Molecular Cell*. They then reviewed the relevant files recovered from the hard drive images and observed what appears to be the original gel scan for the figure (reflected in timing2.bip, last modified 1/21/2010 9:34 AM and timing2.jpg, last modified 1/21/2010 10:47 AM.) This original scan appears to contain a distinct upper and lower portion of data.

timing2.jpg (From Gel Imaging Station)
1/21/2010 10:47 AM

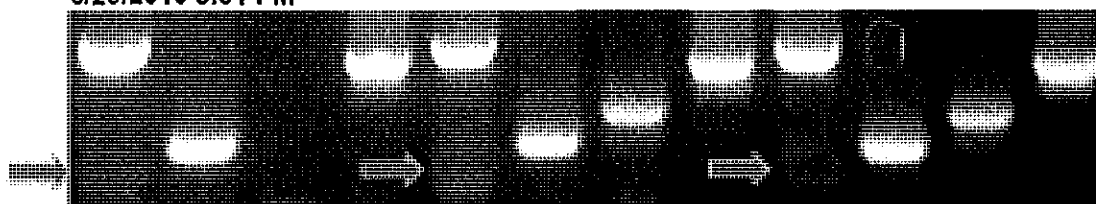


The file timing2-B.psd, last modified 4/30/2010 12:22 PM reflects only the lower portion of the data. The file timing2-B-2.psd, last modified 6/29/2010 5:31 PM reflects that lower portion of data with portions of the lanes cropped out isolating the bands that appear to be reflected in the final figure and some additional bands. The location of the "excised" bands are indicated by the red arrows in this figure [note how the bands indicated by the red arrows in the file timing2-B.psd (From Sauer Laptop) 4/30/2010 12:22 PM are absent in the file timing2-B-2.psd (From Sauer Laptop) 6/29/2010 5:31 PM].

timing2-B.psd (From Sauer Laptop)
4/30/2010 12:22 PM



timing2-B-2.psd (From Sauer Laptop)
6/29/2010 5:31 PM



The file timing--new-3.psd, last modified 8/10/2010 9:15 PM appears to have levels/contrast adjusted to further highlight the bands that appear in the final figure and edit out the additional bands. Calforensics concluded that the original data for this figure was cropped and levels adjusted to edit out additional bands thereby further isolating only the bands shown in the final figure.

timing--new-3.psd (From Sauer laptop)
8/10/2010 9:15 PM



In the interview with [redacted], on 5/11/12 (**Appendix 15**), [redacted] stated that the primer dimer bands (those indicated by the red arrows above) could be “removed” by just enhancing the contrast of this image (p. 21). However, that Dr. Sauer had the altered falsified file timing-2-B-2.psd on his laptop computer in which these bands had been excised indicates that he purposefully manipulated this image to remove the primer-dimers so they would not appear in the final figure submitted to the journal.

Allegation 12: Investigation Committee Conclusions

Paper 8, Supplement Fig. S1C – lower right hand panel has had gel bands removed in creating the image that was submitted for publication. The presence of the file timing-2-B-2.psd, last modified 6/29/2010 5:31 PM on Dr. Sauer's laptop indicates that he had purposefully removed these bands in preparing the final figure. Based upon a preponderance of the evidence, the Committee concludes this act is research misconduct because it constitutes data falsification. Further, such conduct represents a significant departure from the accepted practices of Dr. Sauer's research community, and was committed recklessly.

New Allegation 13 that resulted from interviews

That a manuscript submitted to Nature in 2005 entitled “Role of TAF1-mediated mono-ubiquitination of histone H1 in transcriptional activation” by [redacted] and Frank Sauer contained fabricated data.

During the course of the interviews (**Appendix 15**) the Committee learned that a manuscript had been submitted to Nature in 2005 entitled “Role of TAF1-mediated mono-ubiquitination of histone H1 in transcriptional activation” by [redacted] and Frank Sauer. The interviewee stated that when [redacted] questioned Dr. Sauer as to the reason for the rejection, Dr. Sauer responded that one of the reviewers commented the results were “too black and white”. The RIO contacted *Nature*

magazine who provided a copy of the submitted manuscript and the reviews (Appendix 24) of this manuscript that was never accepted for publication by *Nature*.

Comments made by Referee 2 included the statement:

"There are serious concerns about some of the data shown.

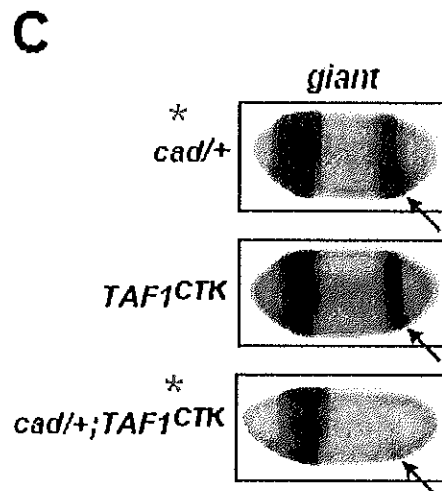
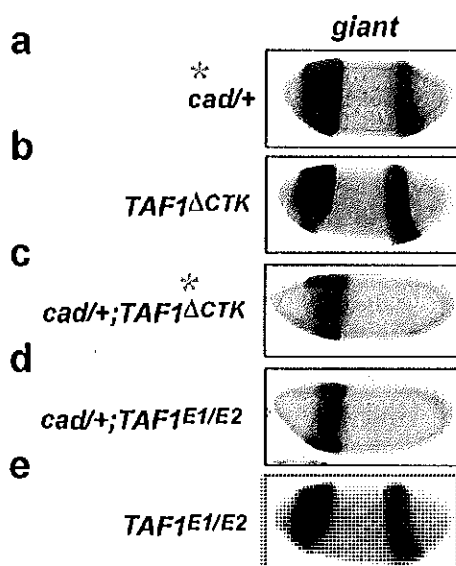
First, the embryo shape and staining in Figure 2a (in this manuscript) appears to be identical to the embryo shown in the top panel in Figure 4C of the previously published Maile paper (Science, 2004). Are the authors positive that Figure 2a in the current manuscript is new, independently obtained data?

Second, the nine bands in Figure 2i and nine of the bands in Figure 3e (all but the first) are identical in shape and in order from left to right (ignoring the blank lanes). This similarity includes a random spot that appears above the bands in lane 3 of Figure 2i and lane 4 of Figure 3e. Is this a rather surprising coincidence or was an error made in generating these figures?"

Regarding the embryo shape and staining in Figure 2a and the top panel in Figure 4C of the previously published Maile paper (Science, 2004) the original figures submitted are shown below. The pairs of duplicated images in these two papers are indicated by *:

Fig 2, Panels a - e. "Role of TAF1-mediated mono-ubiquitination of histone H1 in transcriptional activation" by Tobias Maile, Frank Sauer

Paper 5. Fig 4C. TAF1 Activates Transcription by Phosphorylation of Serine 33 in Histone H2B Tobias Maile, Simona Kwoczynski, Rebecca J. Katzenberger, David A. Wassarman, & Frank Sauer. (2004) *Science* 304, 1010 – 1014.

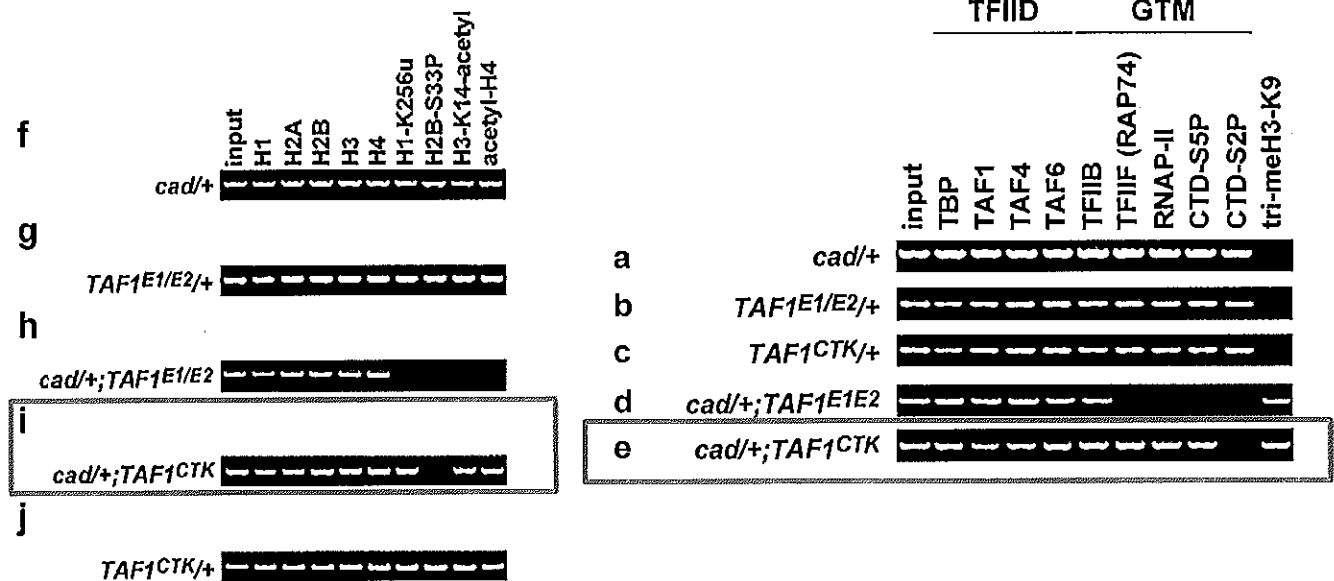


Comparison of the two pairs of embryos that the reviewer questioned as being “new, independently obtained data” were directly compared in **Appendix 18** IC74 and IC75 where it can be concluded that they are identical based on the shape of the major and background staining of these images that appear to perfectly match.

Regarding the nine bands in Figure 2i and nine bands in Figure 3e (all but the first), these are shown below:

Fig 2, Panels f - j. Manuscript:
“Role of TAF1-mediated mono-ubiquitination
of histone H1 in transcriptional activation”
by
Frank Sauer. Submitted to Nature in 2005

Figure 3. Manuscript: Role of TAF1-
mediated mono-ubiquitination of histone
H1 intranuclear transcriptional activation.
and Frank Sauer.
Submitted to Nature in 2005



When the sizes and shapes of Figs. Panels 2i and 3e are adjusted so they have the same size it can be seen by comparing IC78 and IC79 in **Appendix 18** that these gel bands are identical except that the 2nd band to the right in Fig 2i is shifted left one lane in Fig 3e, a clear case of data fabrication and falsification (see next page). Furthermore the identities of each of these gel lanes are identified as being quite different in these two figures. Finally, this similarity includes a random spot that can be clearly seen above the bands in lane 3 of Figure 2i and lane 4 of Figure 3e (compare IC78 and IC79 in **Appendix 18** and next page).

Fig 2i. manuscript submitted to *Nature* 2005

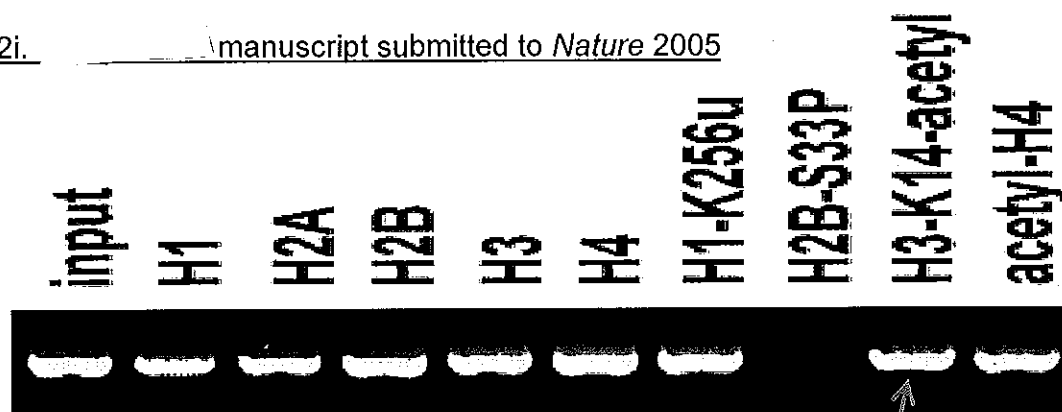
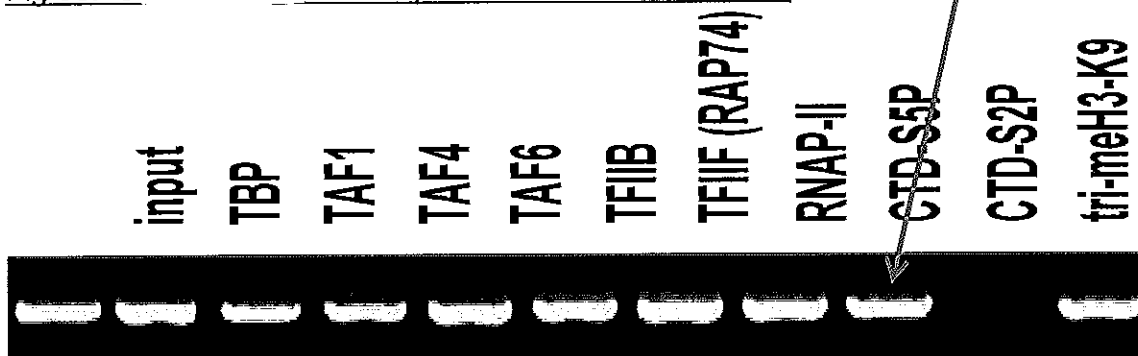


Fig 3e. manuscript submitted to *Nature* 2005



Careful comparison of enlarged views of these two lanes (from Fig. 2i and Fig 3e) show the white spot noted by the reviewer above the 3rd and 4th bands respectively in these two figures, and the identity of the two shifted bands in the two gels indicated by the red arrow above. He will have an opportunity to provide comment during that review.

It should be noted that Dr. Sauer was not advised of this most recent allegation so had no opportunity to respond to this finding before his review of the Investigation Report.

Allegation 13: Investigation Committee Conclusions

The Committee concludes that the embryo shape and staining in Figure 2a of the 2005 manuscript submitted to *Nature*, and the top panel in Figure 4C of the previously published Maile Paper 5, are identical so this is fabrication of data. In addition the Committee concluded that the nine bands in Figure 2i and nine bands in Figure 3e of the 2005 manuscript submitted to *Nature* are identical and this is falsification and fabrication of data. Based upon a preponderance of the evidence, the Committee concludes these acts are research misconduct because such acts constitute data falsification and fabrication. Further, such conduct represents a significant departure from the accepted practices of Dr. Sauer's research community, and due to its nature it was committed intentionally and knowingly.

ANALYSIS OF THE INDIVIDUAL ALLEGATIONS

Allegations Dismissed by the Committee

Allegation #1

*Data fabrications in **Paper 1** (Science. 1995 Dec 15;270(5243):1783-8) and **Paper 2** (Science. 1995 Dec 15;270(5243):1825-8).*

The Western Blots in Fig. 2A of Paper 1 and Fig. 1B of Paper 2 are exactly the same. However, they were supposed to be obtained by two completely different experiments: the experiment of Fig. 2A in Paper 1 used Flag-BCD-Q and the one of Fig. 1B of Paper 2 used Flag-BCD to pull down the other proteins. According to Sauer et. al. BCD is the full length protein and BCD-Q is the truncated version.

Dr. Sauer has been unable to locate any materials (including notebooks and/or original films or files) related to this allegation. (Source: Notes of 10/19/11 SF meeting with Dr. Sauer – **Appendix 5**.) Given the length of time that has elapsed since this article was published and thus the likelihood that the original data may have been mislaid, the Inquiry Committee had dismissed this allegation.

Investigation Committee Conclusions Regarding Allegation #1

Due to the lack of any physical evidence related to the allegation (Source: **Appendix 5**) and given the significant time that has elapsed since this publication, the Inquiry Committee had dismissed this allegation so this was not pursued by the Investigation Committee.

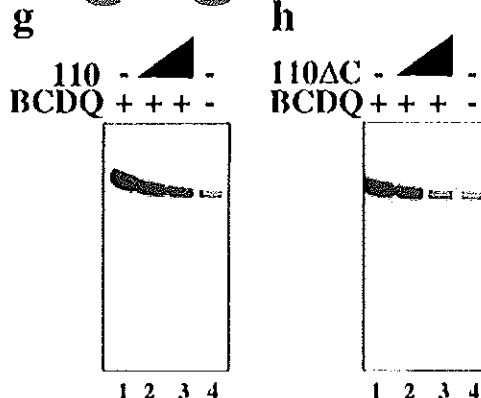
Allegation #2.

*Autoradiogram of Lanes 9-12 in Fig. 1D of **Paper 1** are the same as autoradiogram of Lanes 1-4 (in the reversed order) in Fig. 3h of a later retracted Cell **Paper 3** (Cell. 1996 Dec 27;87(7):1271-84). However, they are totally different experiments. Moreover, autoradiogram of Lanes 1-3 in Fig. 3h is the same as that of Lanes 2-4 in Fig. 3g of the retracted Cell **Paper 3**.*

Fig1D



Fig3g and h



Although Dr. Sauer had been unable to locate any materials (including notebooks and/or original films or files) related to this allegation (Source: **Appendix 5**) the images from the on-line PDF of the publications were further analyzed by the Investigation Committee to assess whether these allegations had substance (see IC70 in **Appendix 18**).

When a direct comparison of these images is made after adjusting the size of the two gel images so lanes are equidistant (IC70.1 and IC70.2 in **Appendix 18**) it appears that there is significant similarity between lanes 12-10 in Fig 1D of Paper 1 with lanes 1-3 in Fig 3h of Paper 3; however, the fourth lane in these two figures does not appear to be the same. Given the absence of any background in these gels it is not possible to determine whether this fourth lane was spliced in one of these gel images. The strongest similarity is that of the single band in lane 10 of Fig 1D of Paper 1 with lanes 3 in Fig 3h of Paper 3 – each bump in the band is replicated in these two figures. Because of the thickness of lanes 12-11 in Fig 1D of Paper 1 and lanes 1-2 in Fig 3h of Paper 3 it is not certain that these are replicates of the same gel lanes. However, given the length of time that has elapsed since this article was published and thus the likelihood that the original data may have been mislaid, the Inquiry Committee had dismissed this allegation.

Allegation #2: Investigation Committee Conclusions

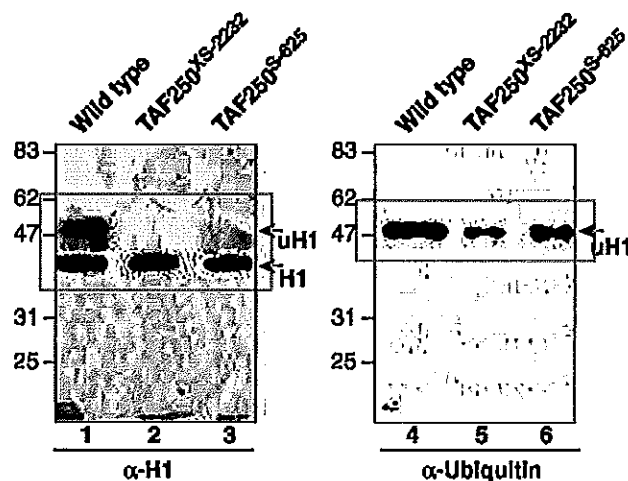
Due to the lack of any physical evidence related to the allegation, it is difficult to assess this allegation although the analysis of the figures derived from the publication does provide strong evidence that at least three of the gel lanes are the same in these two figures. However, given the length of time that has elapsed since this article was published and thus the likelihood that the original data may have been mislaid, and because of the absence of any of the physical evidence or electronic files relating to these two papers, the Committee dismissed this allegation.

Allegation #3.

Data fabrication in *Paper 4 Science*. 2000 Sep 29;289(5488):2357-60.

We highly suspect that protein bands in both panels of Fig. 4 were heavily manipulated. Due to our technical limitations, we do not know if these bands were pasted to the blot.

Appendix 7: Science communication with CFL 11/18/11: [1052614fig4_yf.pdf]



Science provided an analysis after adjustment of the levels in the PDF of this figure taken from their website and observed banding that raised suspicion:

Dr. Sauer provided the RIO with the following digital images (Appendix 8 – that the RIO provided to Calforensics) as being relevant to Figure 4:

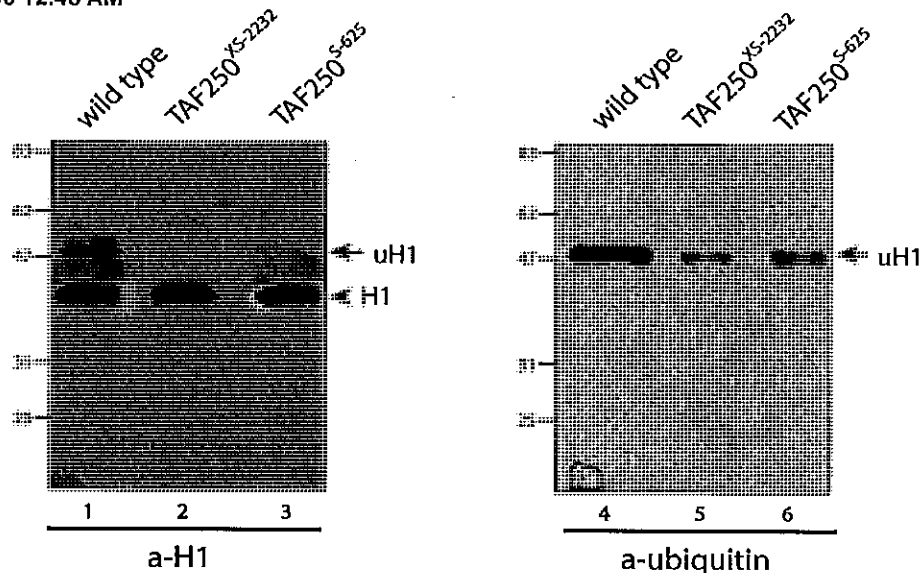
- Pham&Sauer Figure 4-1, an Adobe Illustrator file last modified 2/12/2000 7:56 PM;
- Sauer 1-A.psd, last modified 7/11/2000 7:06 PM;
- Sauer anti-H1Bq.psd, last modified 7/12/2000 7:07 PM;
- Pham&Sauer Figure 4, an Adobe Illustrator file last modified 7/12/2000 11:33 PM;
- Figure 4 second panel.psd, last modified 7/12/2000 11:50 PM;
- Sauer 2.psd, last modified 7/13/2000 2:58 AM;
- Sauer 2ABq-1.psd, last modified 7/21/2000 1:46 AM;
- Figure 4 second panel, an Adobe Illustrator file last modified 7/21/2000 1:51 AM;
- Sauer 2ABq-4.psd, last modified 7/21/2000 2:16 AM;
- Sauer 2ABq-3-1.psd, last modified 7/21/2000 2:23 AM;
- Sauer 2ABq-4-1.psd, last modified 7/21/2000 2:25 AM;
- Sauer 2ABq-1-1.psd, last modified 7/21/2000 2:27 AM;
- Figure 4, second p-3-1-1.psd, last modified 7/21/2000 2:28 AM;
- Figure 4 second panel-1.psd, last modified 7/21/2000 2:29 AM;
- Pham&Sauer Figure 4-2, an Adobe Illustrator file last modified 7/21/2000 4:40 AM;

- Figure 4, second p – 3.psd, last modified 7/21/2000 1:59 PM; and
- Sauer 2ABq-3.psd, last modified 7/21/2002 2:16 AM.

Calforensics reviewed the hard drive forensic images they acquired from the sequestered computers and did not recover files relevant to this figure.

Calforensics found that the Adobe Illustrator file Pham&Sauer Figure 4-1, last modified 7/22/2000 12:48 AM (on Dr. Sauer's laptop in file path Users/fus/Desktop/Science Riddihough/science supplement/figure 2) contains the blocks around the bands as noted by *Science*.

Pham&Sauer Figure 4-1 (From Sauer Laptop)
7/22/2000 12:48 AM



There are multiple Adobe Illustrator versions of the figure on the Sauer laptop. The data across all versions appears to be the same, and the artifacts alleged by *Science* appear in all versions, but Calforensics was not able to conclude that these artifacts are evidence of splicing.

Allegation #3: Investigation Committee Conclusions

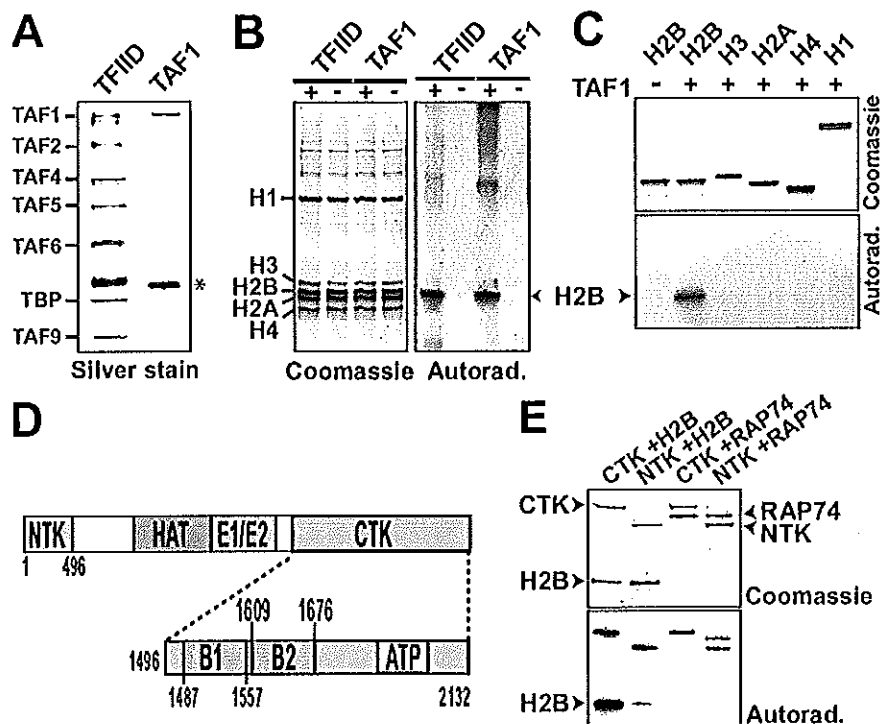
Because no image of an original scan for this figure was available, and given the length of time that has elapsed since this article was published (2000) and thus the likelihood that the original data may have been mislaid, and that there are no clear indicia of splicing in the images provided by Dr. Sauer, the Investigation Committee dismissed this allegation.

Allegation #5: Paper 5 Science 2004 May 14;304(5673):1010-4. We highly suspect that protein bands in Figs. 1A, 1C, 1E, 3D were heavily manipulated. Due to our technical limitations, we do not know if these bands were pasted to the blot.

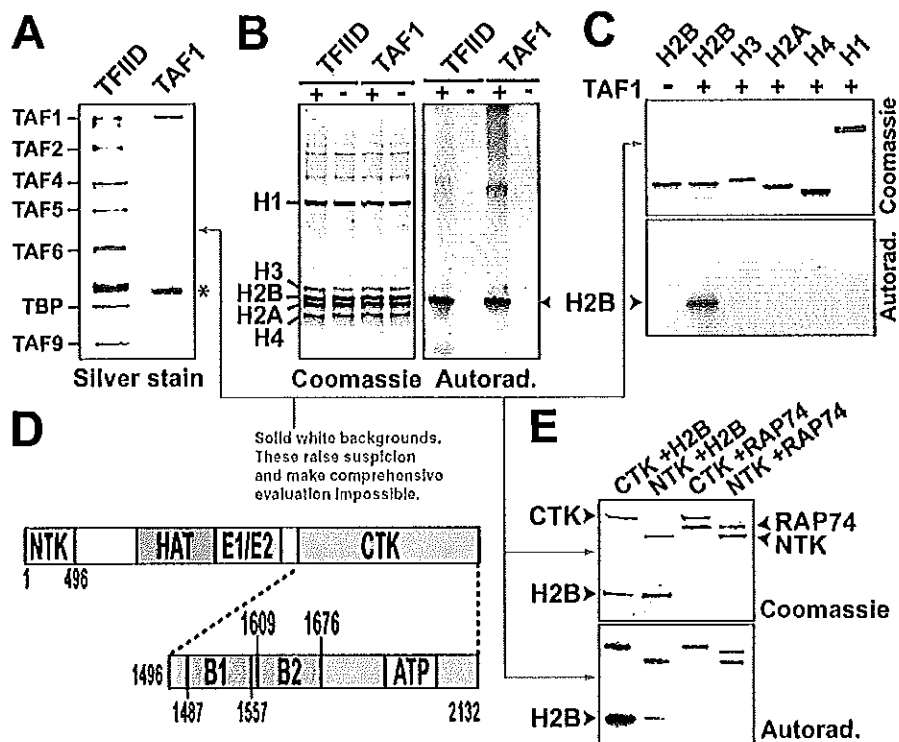
Allegation 5.1: Paper 5 [Science 2004 May 14;304(5673):1010-4]. The allegation that the protein bands in Figs. 1A were heavily manipulated.

Original Figure submitted by Dr. Sauer to Science for publication

Paper 5, Fig 1



Appendix 7: Science communication with CFL 11/18/11: [1095001fig1_yf.pdf]

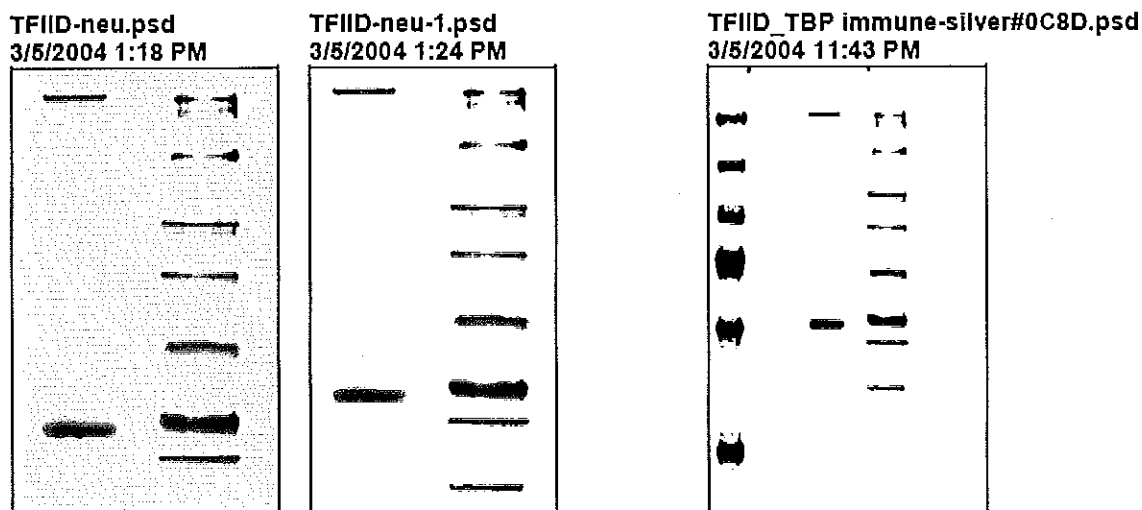


Science observed that the data comprising multiple figures in the paper *Science* 2004 May 14;304(5673):1010-4 appeared to have been heavily manipulated suggesting that bands may have been pasted/spliced to blots. In many figures, black bands appear on solid white backgrounds making comprehensive evaluation impossible. *Science* specifically noted Figures 1A, 1C, 1E, 2C, 3A, 3B, 3C, 3D and S5C. Dr. Sauer provided multiple psd files relative to the various figures in this paper. Calforensics observed that most of the psd files provided by Dr. Sauer contained the solid white background with one layer of the bands.

Calforensics reviewed the hard drive forensic images they acquired from the sequestered computers and did not recover files relevant to this figure.

Dr. Sauer provided the RIO with the following digital images (Appendix 8 – that the RIO provided to Calforensics) as being relevant to Figure 1A:

- TFIID-neu.psd, last modified 3/5/2004 1:18 PM;
- TFIID-neu-1.psd, last modified 3/5/2004 1:24 PM;
- TFIID_TBP immune-silver#0C8D.psd, last modified 3/5/2004 11:43 PM; and
- 1095001fig1.eps, last modified 4/14/2004 11:23 AM.



Calforensics reviewed these files provided by Dr. Sauer that he suggested were relevant to Figure 1A and observed that the three psd files contain the black bands on solid white backgrounds as in the final figure. After applying adjustments, no indicia of splicing in these images were observed. They noted, however, that the file TFIID_TBP immune-silver#0C8D.psd, last modified 3/5/2004 11:43 PM contains an additional lane of bands that is not visible in TFIID-neu.psd, last modified 3/5/2004 1:18 PM and TFIID-neu-1.psd, last modified 3/5/2004 1:24 PM – a molecular mass lane so understandable. The latter two files appear to contain the same image but with minor adjustments to output levels from one file to the next and one band cropped out of the right lane at the

bottom of TFIID-neu.psd. It is likely that TFIID-neu-1.psd was used to create the final figure. This image, however, was inverted horizontally in the final figure.

Allegation 5.1: Investigation Committee Conclusions

Because there are no clear indicia of splicing in the images provided by Dr. Sauer, the Investigation Committee dismissed this allegation.

Allegation 5.2: *Paper 5 [Science 2004 May 14; 304 (5673):1010-4]. The allegation that the protein bands in Fig. 1C were heavily manipulated.*

Appendix 7: Science communication with CFL11/18/11: [1095001fig2_yf.pdf]

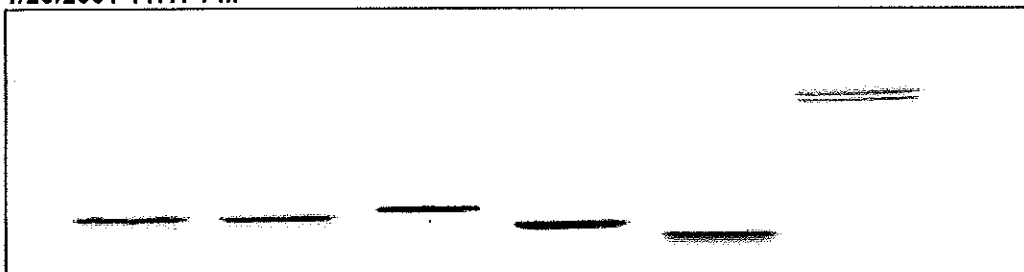
Science identified an additional figure (Figure 2) in Paper 5 that appeared to be falsified.

Dr. Sauer provided the following files as being relevant to **Figure 1C**:

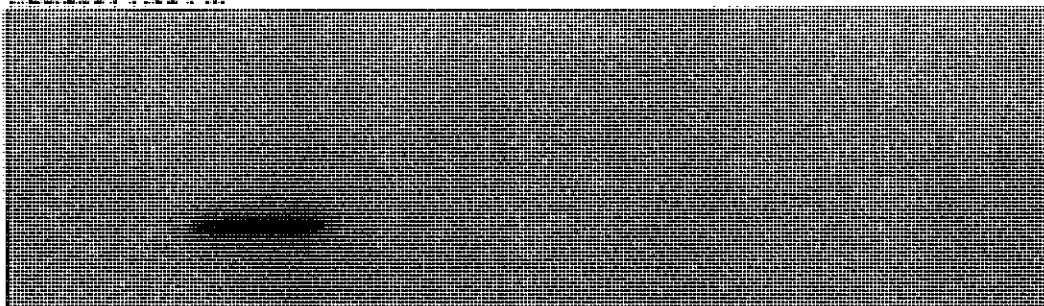
- histones kinase assay scan gel.psd, last modified 1/20/2001 11:17 PM;
- histones kinase assay.psd, last modified 1/26/2001 7:08 PM; and
- 1095001fig1.eps, last modified 4/14/2004 11:23 AM.

Calforensics reviewed the files (histones kinase assay scan gel.psd, last modified 1/20/2001 11:17 PM and histones kinase assay.psd, last modified PM) provided by Dr. Sauer that he suggested were relevant to Figure 1C and observed that the two psd files contain the black bands on solid white backgrounds as in the final figure. After applying adjustments, no indicia of splicing in these images were observed. The two files appear to contain the same images as in the final figure. Because they do not have an image of an original scan for this figure and they did not see indicia of splicing in the images provided by Dr. Sauer, they could not conclude the data was manipulated.

histones kinase assay scan gel.psd
1/20/2001 11:17 PM



histones kinase assay.psd
1/26/2001 7:08 PM



Allegation 5.2: Investigation Committee Conclusions

Because there are no clear indicia of splicing in the images provided by Dr. Sauer, the Investigation Committee dismissed this allegation.

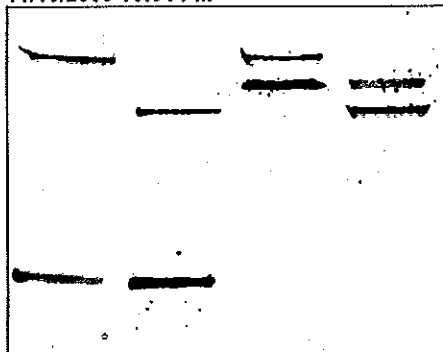
Allegation 5.3: *Paper 5 [Science 2004 May 14;304(5673):1010-4]. The allegation that the bands in Fig. 1E were heavily manipulated.*

Dr. Sauer provided the RIO with the following digital images (**Appendix 8** – that the RIO provided to Calforensics) as being relevant to **Figure 1E**:

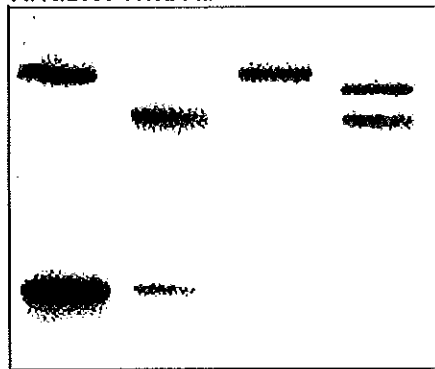
- CTK-NTK-coomassie.psd, last modified 11/16/2003 10:34 PM;
- NTK-CTK-kinase-assays.psd, last modified 11/16/2003 10:52 PM; and
- 1095001fig1.eps, last modified 4/14/2004 11:23 AM.

Calforensics reviewed the files (CTK-NTK-coomassie.psd, last modified 11/16/2003 10:34 PM and NTK-CTK-kinase-assays.psd last modified 11/16/2003 10:52 PM) provided by Dr. Sauer that he suggested were relevant to Figure 1E, and they observed that the two psd files contain the black bands on solid white backgrounds as in the final figure.

CTK-NTK-coomassie
11/16/2003 10:34 PM



NTK-CTK-kinase assays
11/16/2003 10:52 PM



After applying adjustments, Calforensics observed no indicia of splicing in these images. The two files appear to contain the same images as in the final figure. Because Calforensics did not have an image of an original scan for this figure and did not see indicia of splicing in the images provided by Dr. Sauer, they were unable to conclude that data had been manipulated.

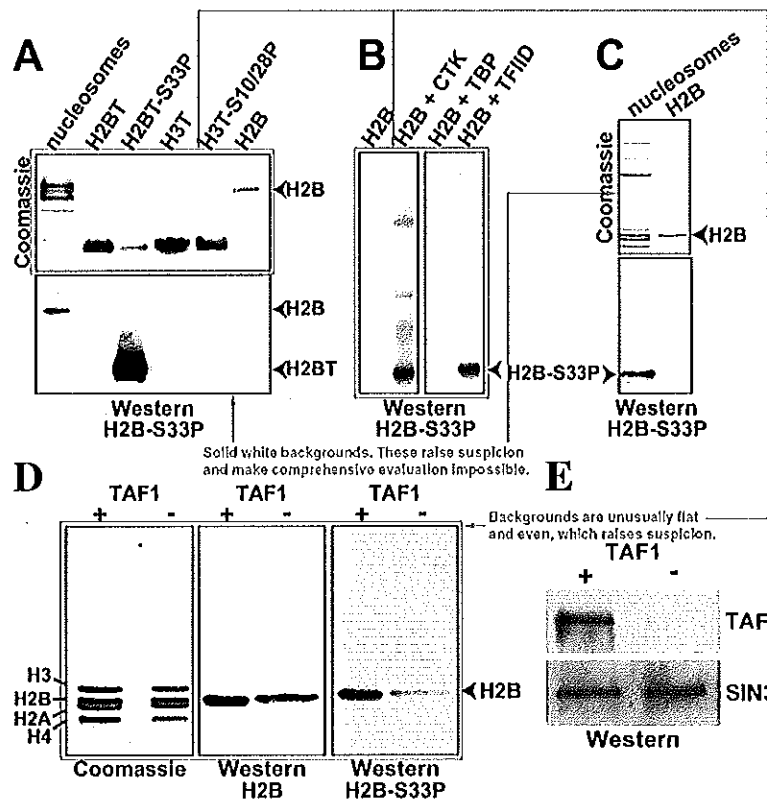
Allegation 5.3: Investigation Committee Conclusions

Because there are no clear indicia of splicing in the images provided by Dr. Sauer, the Investigation Committee dismissed this allegation.

Allegation 5.5: Paper 5 [Science 2004 May 14;304(5673):1010-4]. The allegation that the protein bands in Fig. 3A was falsified.

Paper 5, Fig 3 (1st Version)

Appendix 7: Science communication 11/18/11: [1095001fig 3_yf_1 of 2.pdf] :



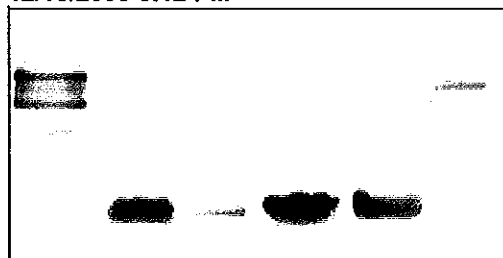
Science identified an additional figure (Figure 3) in Paper 5 that appeared to be falsified as the unusually flat, solid white backgrounds raised suspicion and made comprehensive evaluation impossible.

Dr. Sauer provided the RIO with the following digital images (Appendix 8 – that the RIO provided to Calforensics) as being relevant to **Figure 3A**:

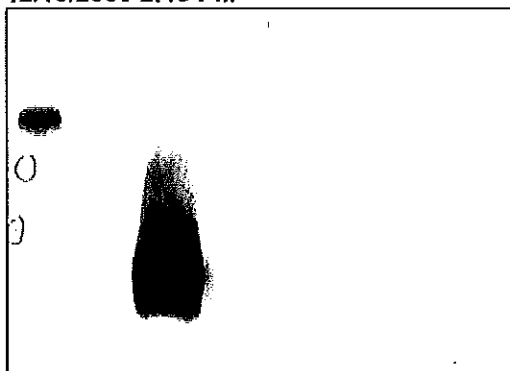
- Tobias1.psd, last modified 12/18/2003 2:43 PM;
- Tobias1A.psd, last modified 12/18/2003 3:07 PM;
- Tobias1A1.psd, last modified 12/18/2003 3:07 PM;
- frank113.psd, last modified 12/18/2003 3:12 PM; and
- 095001fig3.eps, last modified 4/14/2004 7:55 AM.

Calforensics reviewed the files provided by Dr. Sauer that he suggested were relevant to Figure 3A and observed that the four psd files contain the black bands on solid white backgrounds as in the final figure. After applying adjustments, Calforensics observed no indicia of splicing in these images. The files Tobias1.psd, last modified 12/18/2003 2:43 PM; Tobias1A.psd, last modified 12/18/2003 3:07 PM; and Tobias1A1.psd, last modified 12/18/2003 3:07 PM appear to contain the same image as in the lower panel in the final figure only with some transformation of proportion of the bands from Tobias1A.psd to Tobias1A1.psd. Tobias1A1.psd was likely the image used for the final figure. Although they saw some transformation of data between the psd files Dr. Sauer provided, they did not have an image of an original scan for this figure and therefore could not conclude the experimental data was manipulated.

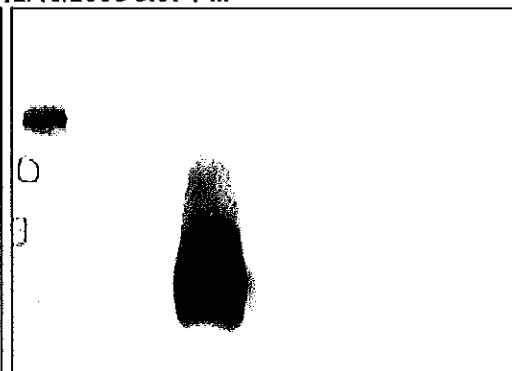
frank113.psd
12/18/2003 3:12 PM



Tobias1.psd
12/18/2003 2:43 PM



Tobias1A.psd
12/18/2003 3:07 PM



In addition on 6/18/12 Dr. Sauer presented Item 57 that he claimed was copy of the original Paper 5 Fig. 3A upper panel that appeared to have no artifacts. The gel image did look very similar to the figure published in the paper and well may have been the experiment used to generate the final figure.

Allegation 5.5: Investigation Committee Conclusions

Because there are no clear indicia of splicing in the images provided by Dr. Sauer, the Investigation Committee dismissed this allegation.

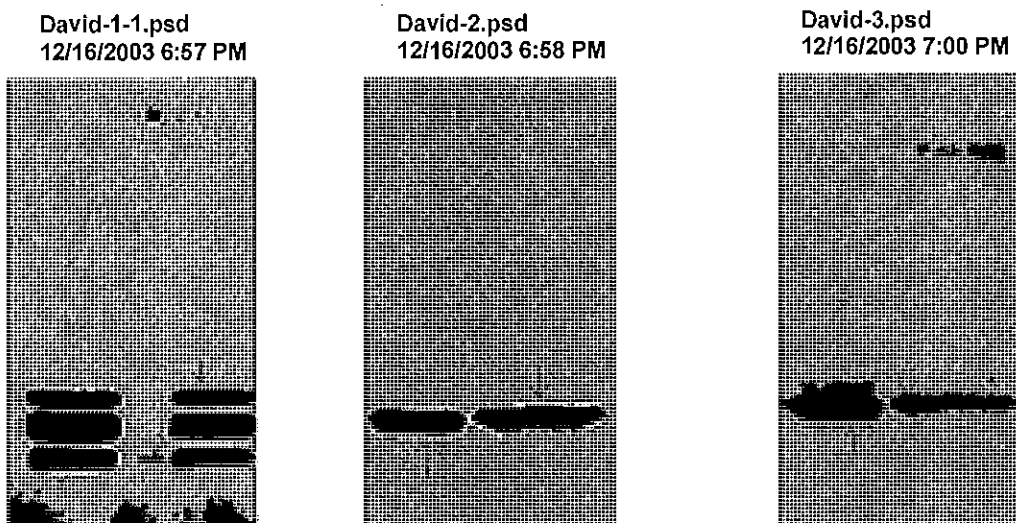
Allegation 5.8: *Paper 5 [Science 2004 May 14;304(5673):1010-4]. The allegation that the protein bands in Fig. 3D was falsified.*

Dr. Sauer provided the RIO with the following digital images (**Appendix 8** – that the RIO provided to Calforensics) as being relevant to **Figure 3D**:

- RNAi-H2B_(S33P)_12=16=03.ppt, last modified 12/16/2003 12:04 PM;
- David-1.psd, last modified 12/16/2003 6:00 PM
- David-1-1.psd, last modified 12/16/2003 6:57 PM;
- David-2.psd, last modified 12/16/2003 6:58 PM;
- David-3.psd, last modified 12/16/2003 7:00 PM; and
- 1095001fig3.eps, last modified 4/14/2004 7:55 AM.

Science commented that the unusual halos around the bands in these blots raised suspicions (see Allegation 5.6 analysis by *Science*).

Calforensics reviewed the files provided by Dr. Sauer that he suggested were relevant to Figure 3D. These files appear to contain the images represented in all three panels of Figure 3D. David-1.psd, last modified 12/16/2003 6:00 PM and David-1-1.psd, last modified 12/16/2003 6:57 PM appear to contain the same image (as in the left panel of the figure) with David-1-1.psd being a zoomed in version of David-1.psd. After applying adjustments, Calforensics observed indicia of either splicing or selection of bands using a selection tool and then alteration of the selected bands in all four files. Calforensics also observed, after applying adjustments, this indicia in the Sauer provided file 1095001fig3.eps, last modified 4/14/2004. Therefore, although Calforensics did not have an original scan, they concluded that due to the indicia of possible splicing or other alterations in the psd and eps files provided by Dr. Sauer that experimental data for Figure 3D was manipulated.



After careful review the Committee decided that the abnormal appearance of these bands with a white outline was likely due to the way these images had been “manipulated” in Photoshop. Specifically, that the contrast was inappropriately enhanced to the point that only the major bands remained visible that now had a white outline. Furthermore, these experiments were identified by [redacted] in his interview with the Committee (**Appendix 15**) as experiments he had performed and the identifier for these three files on the Sauer lab computer was “David”. Based on these observations the Committee decided that there was insufficient evidence to conclude that the manipulation of these images rose to the level of research misconduct.

Allegation 5.8: Investigation Committee Conclusions

The Committee concluded that Paper 5 Figure 3D had been manipulated and there were indicia of using a selection tool to select bands and make some sort of alteration to the gel images. However, the Committee dismissed this allegation as the manipulated images likely represented original data.

Allegation 8.5: *We highly suspect that in Paper 6 (Nature. 2002) protein bands in Fig. 4e were heavily manipulated.*

Allegation 8.5: Investigation Committee Conclusions

The Committee could not conclude Fig. 4e in Paper 6 was fabricated and therefore dismiss this allegation.

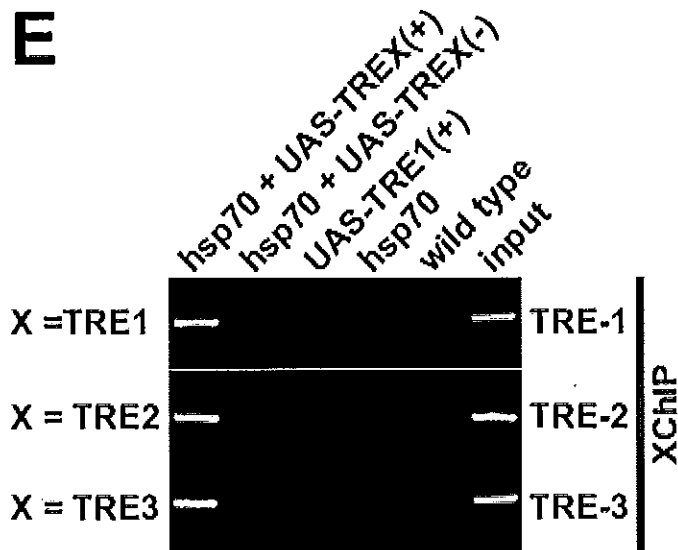
Allegation 8.6: *We highly suspect that in Paper 6 (Nature. 2002) protein bands in Fig. 4g were heavily manipulated.*

Allegation 8.6: Investigation Committee Conclusions

The Committee could not conclude Fig. 4g in Paper 6 was fabricated and therefore dismiss this allegation.

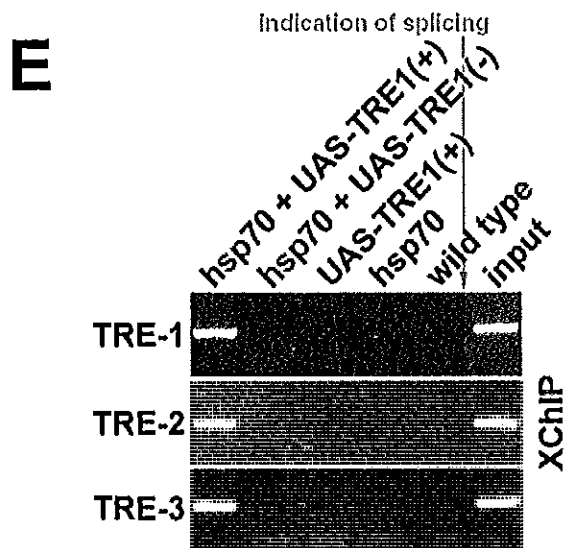
Allegation 10.4: That different gels have been spliced together in creating Fig. 6E in Paper 7.

Paper 7, Fig 6E submitted by Dr. Sauer for publication in *Science*



Based on the figure submitted by Dr. Sauer, *Science* noted that different gels appeared to be spliced together to create this figure which was presented as if it were a single unmodified gel in Fig 6E.

Science communication 11/18/11: [1117705_Fig6_yf_1 of 2.pdf]



Dr. Sauer provided the RIO with the following digital images (Appendix 8 – that the RIO provided to Calforensics) as being relevant to **Figure 6E**:

- TRE-1(CHIP).psd, last modified 9/11/2005 9:20 PM;
- TRE-3(CHIP).psd, last modified 9/11/2005 9:20 PM;
- TRE-2(CHIP).psd, last modified 9/11/2005 9:21 PM; and
- Fig.6E.psd, last modified 10/2/2005 12:46 PM.

Calforensics reviewed the hard drive forensic images observed on the Sauer Lab Scan Mac in the path “Users/sauerlabscanmac/Desktop/User folders/Tilman/WINGS(Hsp)” the following relevant files:

- TRE-1(CHIP).psd, last modified 9/11/2005 5:11 PM;
- TRE-3(CHIP).psd, last modified 9/11/2005 5:12 PM; and
- TRE-2(CHIP).psd, last modified 9/11/2005 5:58 PM.

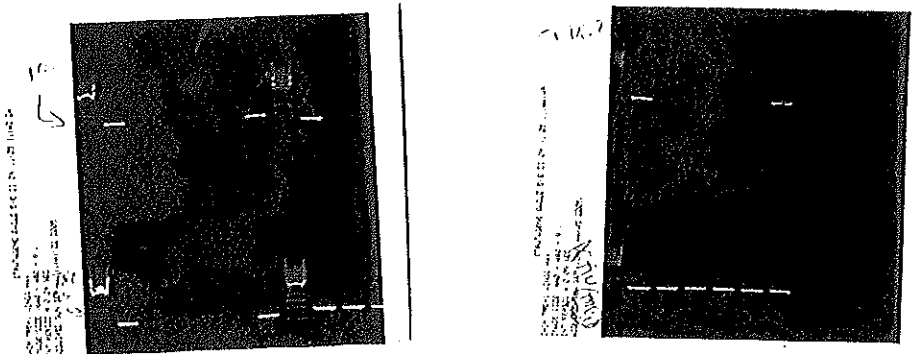
Calforensics also observed on the Sauer Lab Scan Mac in the path “Users/sauerlabscanmac/Desktop/User folders/Tilman” the following relevant files:

- TRE-3(CHIP).tif, last modified 9/11/2005 5:03 PM;
- App0012.tif, last modified 9/11/2005 5:19 PM;
- App0013.tif, last modified 9/11/2005 5:58 PM;
- App0014.tif, last modified 9/11/2005 6:16 PM;
- App0015.tif, last modified 9/11/2005 6:24 PM; and
- App0016.tif, last modified 9/11/2005 6:29 PM.

Calforensics also observed on the Sauer Lab Scan Mac in the path “Users/sauerlabscanmac/Desktop/User folders/Frank” the file App0011.tif, last modified 9/11/2005 5:12 PM.

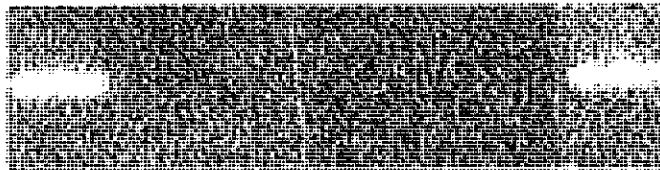
Calforensics reviewed the files provided by Dr. Sauer that he suggested were relevant to Figure 6E. The file Fig.6E.psd, last modified 10/2/2005 12:46 PM, contains two scans. The scan on the left (as shown below) has two sets of bands, the upper set possibly reflective of the data in the top panel of Figure 6E (TRE-1) and the lower set possibly reflective of the data in the bottom panel of Figure 6E (TRE-3). The upper set of bands in the scan on the right appears to contain the data reflected in the second or middle panel of Figure 6E (TRE-2).

Fig.6E.psd
10/2/2005 12:46 PM



Dr. Sauer also provided TRE-1(CHIP).psd, last modified 9/11/2005 9:20 PM; TRE-2(CHIP).psd, last modified 9/11/2005 9:21 PM; and TRE-3(CHIP).psd, last modified 9/11/2005 9:20 PM, which appear to contain the data as reflected in the scans in Fig.6E.psd but with bands cropped out.

TRE-1(CHIP).psd (From Sauer Lab Scan Mac)
9/11/2005 9:20 PM



TRE-2(CHIP).psd (From Dr. Sauer)
9/11/2005 9:21 PM



TRE-3(CHIP).psd (From Dr.
9/11/2005 9:20 PM



Califorensics observed earlier versions of TRE-1(CHIP).psd, TRE-2(CHIP).psd and TRE-3(CHIP).psd on the Sauer Lab Scan Mac. The earlier versions look the same as the latter versions provided by Dr. Sauer. Califorensics also found on the Sauer Lab Scan Mac several files that illustrate the progression of the additional bands being cropped out. For example, App0011.tif, last modified 9/11/2005 5:12 PM reflects the left scan with the typewritten and handwritten markings as well as some bands cropped out. Califorensics observed the artifact as noted by *Science* only in the file TRE-1(CHIP).psd provided by Dr. Sauer. Califorensics could not conclude that this artifact is indicia of splicing. They do conclude, however, that bands were cropped out of the data reflected in the original scans to isolate the bands reflected in the final figure.

Allegation 10.4: Investigation Committee Conclusions

The Committee concluded that gel lanes in the upper panel (TRE-1) in Fig 6E of Paper 7 may have been spliced into this background. However, because Califorensics also found on the Sauer Lab Scan Mac several files that illustrate the progression of the additional bands being cropped out it would appear that this data was correct in the original gel image, but subsequent manipulations made it appear as if the right hand

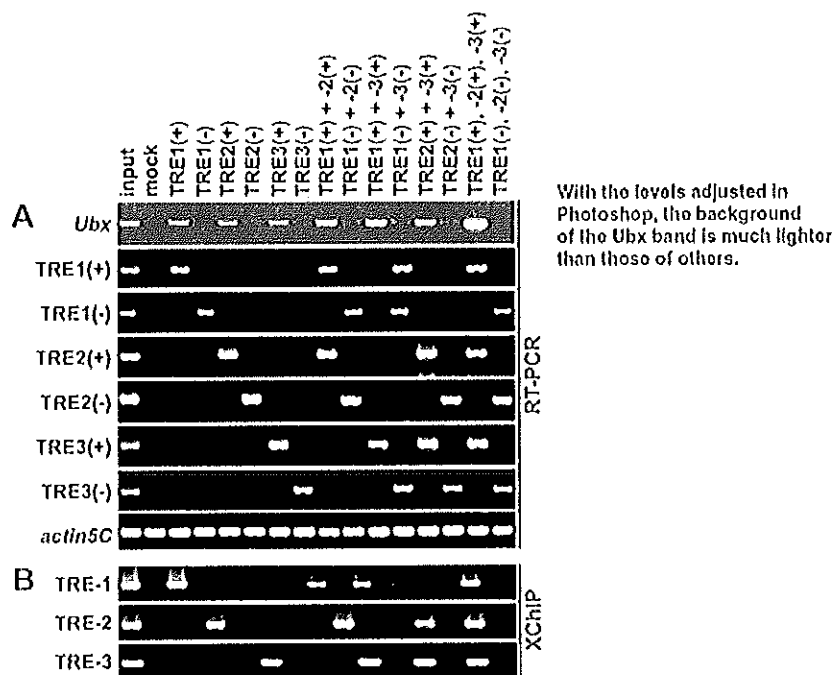
band in TRE-1 had been cropped in. The Committee decided to dismiss this allegation of research misconduct.

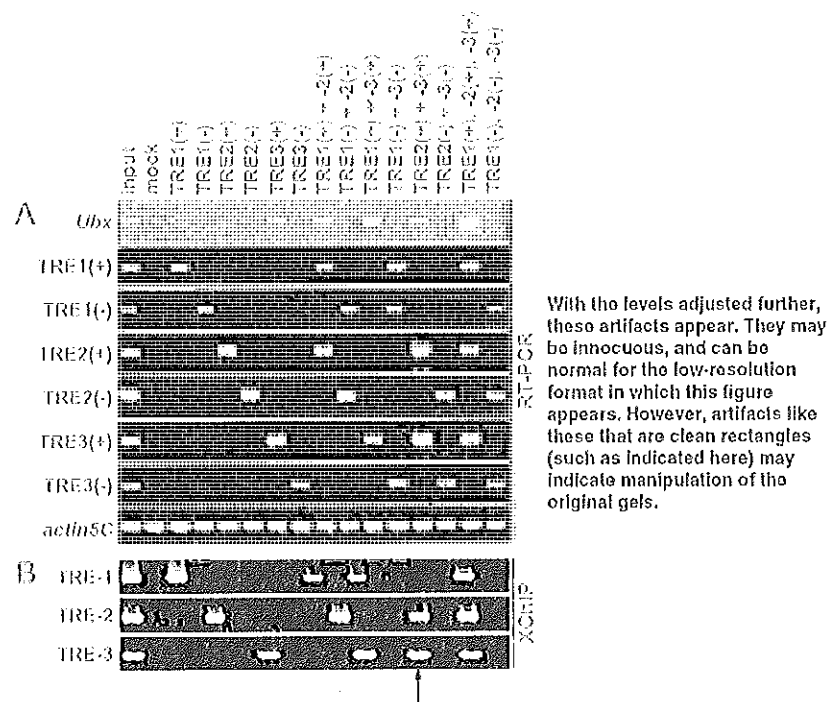
Allegation 10.6: *That different gels have been spliced together in creating Fig. S12, S13, S14 and S16 in Paper 7.*

Based on the figure submitted by Dr. Sauer, *Science* noted that different gels were spliced together to create this figure which was presented as if it were a single gel.

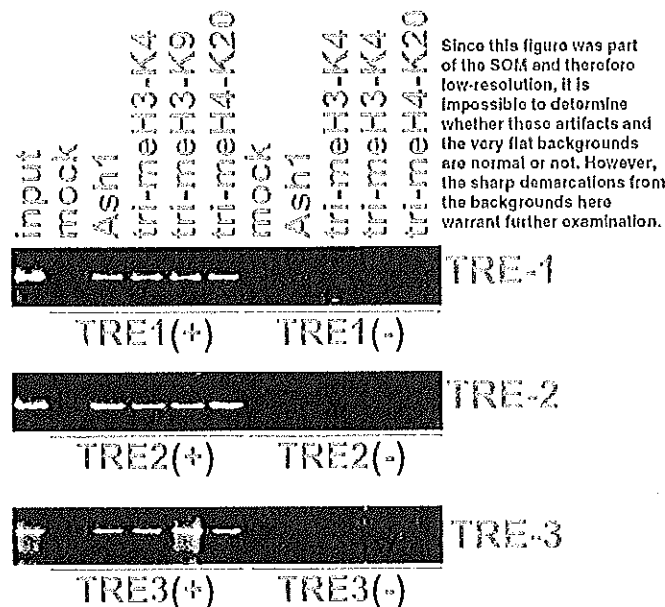
Paper 7, Supplement Fig. S12

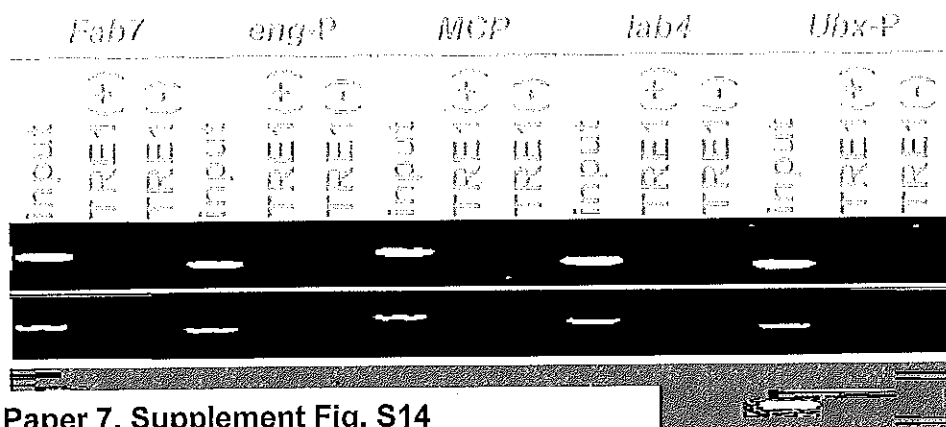
Science communication 11/18/11: [1117705_FigS12_yf_1 of 2.pdf]





Paper 7, Supplement Fig. S13





Paper 7, Supplement Fig. S14

Upon adjustment of the levels in Photoshop, the marked difference in the background in the third band is notable.

As with other low-resolution SOM figures, it is impossible to tell if the artifacts now visible in the third band are normal, or are evidence of manipulation.

Dr. Sauer did not provide any files relevant to Figures S12, S13 and S14 when requested on October 13, 2011, and Calforensics did not recover any relevant files from the hard drive forensic images they acquired. Furthermore, Dr. Sauer acknowledged on October 13, 2011 that he did not have any materials (including notebooks and/or films) related to this allegation because the editors for *Science* requested he send them all the original materials/data, including all figures (see **Appendix 5**). Therefore, Calforensics did not analyze those three figures.

Dr. Sauer provided the PHS ORI with new data on June 18, 2012 that included thermo prints that he claimed were Fig S12, S13, and S14. (We note that because these items were not provided to the RIO, as requested on October 13, 2011, these materials were not sequestered.) Only photocopies of these prints were available for review, as the originals were at PHS ORI. The Committee could not make any conclusions with certainty based on the photocopies, particularly because it did not have the notebook where the experiment is described and the gel thermocopy inserted.

Paper 7, Supplement Fig. S16

Paper 7, Original Fig. S16 submitted by Dr. Sauer for publication in *Science*:

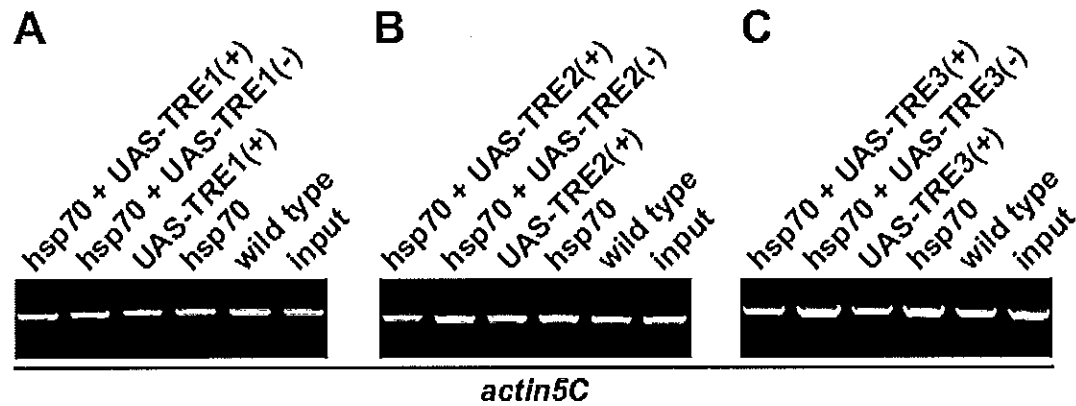
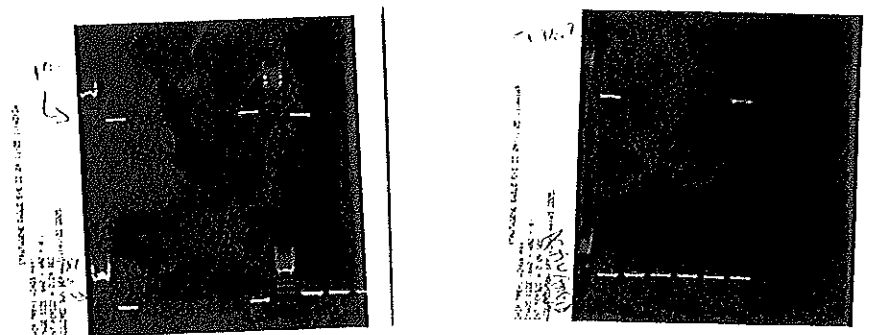
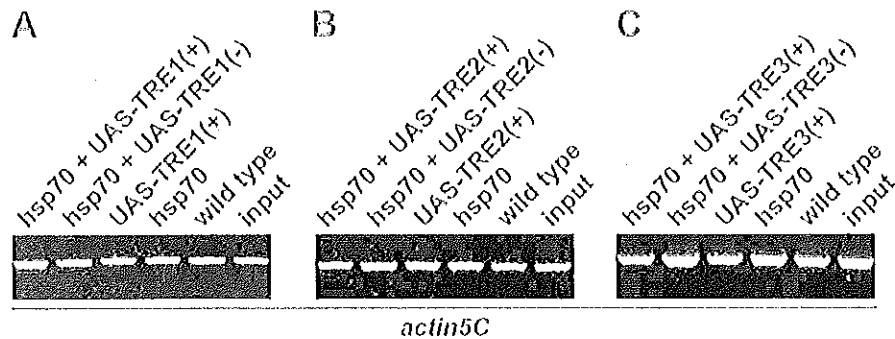


Fig.6E.psd
10/2/2005 12:46 PM



Science communication 11/18/11: [1117705_FigS16_yf.pdf]

Sanchez-Elsner et al.



As discussed with regard to other figures from the SOM, significant pixelation and image artifacts such as visible here are expected with low-resolution figures. However, the demarcations here may be evidence of manipulation, and warrant further investigation.

Science noted sharp edges around the bands in these figures when examined in Photoshop indicating the images may have been manipulated. Clear rectangles are visible around the bands especially in the bottom of the 3 panels.

Dr. Sauer provided the RIO with the following digital images (**Appendix 8** – that the RIO provided to Calforensics) as being relevant to **Figure S16**:

- TRE-3(Actin-RT).psd, last modified 9/11/2005 9:24 PM
- TRE-1(Actin-RT).psd, last modified 9/11/2005 9:27 PM;
- TRE-2(Actin-RT).psd, last modified 9/11/2005 9:27 PM; and
- 10_2_05_1#4FA0.jpg, last modified 10/2/2005 12:02 PM.

Although Dr. Sauer did not suggest that Fig.6E.psd, last modified 10/2/2005 12:46 PM was relevant to this figure, Calforensics believed it is relevant to **Figure S16**, Panel A. They reviewed the hard drive forensic images acquired by them and observed on the Sauer Lab Scan Mac in the path "Users/sauerlabscanmac/Desktop/User folders/Tilman/WINGS(Hsp)" the following relevant files:

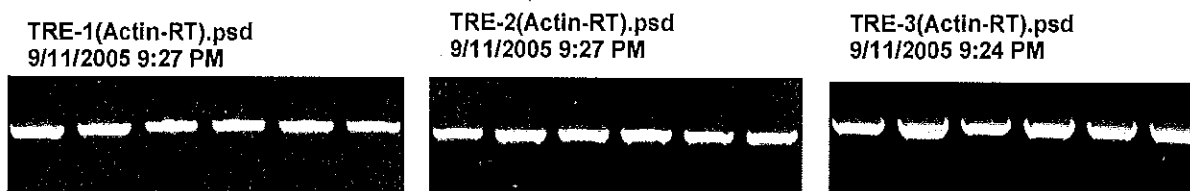
- TRE-1(Actin-RT).psd, last modified 9/11/2005 5:19 PM;
- TRE-2(Actin-RT).psd, last modified 9/11/2005 6:33 PM; and
- TRE-3(Actin-RT).psd, last modified 9/11/2005 7:07 PM.

Dr. Sauer provided scans for Panel A (shown in lower bands in right scan of Fig.6E.psd, last modified 10/2/2005 12:46 PM) and Panel C (shown in upper right scan of 10_2_05_1#4FA0.jpg, last modified 10/2/2005 12:02 PM).

10_2_05_1#4FA0.jpg
10/2/2005 12:02 PM



Dr. Sauer did not identify a scan relevant to Panel B. Dr. Sauer provided three psd files: TRE-1(Actin-RT).psd 9/11/2005 9:27 PM TRE-1(Actin-RT), last modified 9/11/2005 9:27 PM; TRE-2(Actin-RT).psd, last modified 9/11/2005 9:27 PM; and TRE-3(Actin-RT).psd, last modified 9/11/2005 9:24 PM, which appear to contain the data as reflected in Panels A, B and C, respectively, in the final figure.



TRE-1(Actin-RT).psd and TRE-3(Actin-RT).psd appear to contain the same data as reflected in the scans but with some bands cropped out. We observed on the Sauer Lab Scan Mac TRE-1(Actin-RT).psd, TRE-2(Actin-RT).psd and TRE-3(Actin-RT).psd, which appear to contain the same data as in the psd files with the same names provided by Dr. Sauer. While Calforensics observed the artifacts as noted by *Science* in the pdf file 1117705Sanch.pdf provided by *Science*, they did not observe those artifacts in the jpg and psd files provided by Dr. Sauer or the files observed on the Sauer Lab Scan Mac. They observed no indicia of splicing in the files provided by Dr. Sauer or files observed on the Sauer Lab Scan Mac. Calforensics could not conclude that the artifacts noted by *Science* in the pdf file are indicia of splicing. They do conclude, however, that bands were cropped out of the data reflected in the original scans to isolate the bands reflected in the final Figure S16.

Dr. Sauer provided ORI with a number of evidence items on 6/18/12 (Appendix 23). Items 134 – 143 were claimed to be photocopies of thermocopies of Figs. S12, S13 and S14 from Paper 7. While the Committee concluded that the images do match fairly well to the published figures the concerns of *Science* remain that the contrast adjustments are not the same for all panels and it cannot be concluded for certain whether these are the same in Items 134 – 139 as in S12, 140 and 141 as in S13, and S142 and S143 in S14. Items 144 – 146 were claimed to be photocopies of thermocopies of Fig. Supplement S16. These photocopies do match fairly well to the published figures but it is not possible to tell for certain without the notebook where the experiment is described and the gel thermocopy inserted.

Because these items were not provided to the RIO Dr. Louis, as requested on October 13, 2011, and therefore were not sequestered, there was no assurance that these figures were actually associated with these papers.

Allegation 10.6: Investigation Committee Conclusions

Based on the analysis of these figures conducted by *Science* and the gel photocopy images provided to PHS ORI on June 18, 2012, the gel images in the Figs. S13, S14, and S16, Fig S16 in Paper 7 were possibly derived from unique experiments so the

allegations are dismissed despite remaining concerns whether the figures (as shown in the photocopies) were actually associated with these papers.

Allegation #11

Data fabrications in Paper 8 Mol Cell. 2011 Sep 16;43(6):1040-6.

The DNA electrophoresis of lanes 4-8 and lanes 12-16 in Fig. 4B are almost the same. However, they were supposed to be obtained by two completely different experiments.

Dr. Sauer has been unable to locate any materials (including notebooks and/or films) related to this allegation. (Source: SF meeting with Dr. Sauer and confirmed in 5/25/12 interview.)

Dr. Sauer and [redacted] identified several files which Dr. Sauer indicated were located in a folder titled "Paper in Progress" folder on the Computer labtop Sauer2 (aka: Sauer laptop) and relevant to Figure 4B. The files are named as follows:

- bon2.jpg;
- bon3.jpg;
- bon3.psd;
- Mira-RNAi-1+2Mira/Hoxa6/HoxA7.psd;
- Figure 4; and
- MOLECULAR-CELL-D-11-00428 Figure 4.ai.

Califorensics reviewed the hard drive images and located multiple relevant images. (See analysis below.)

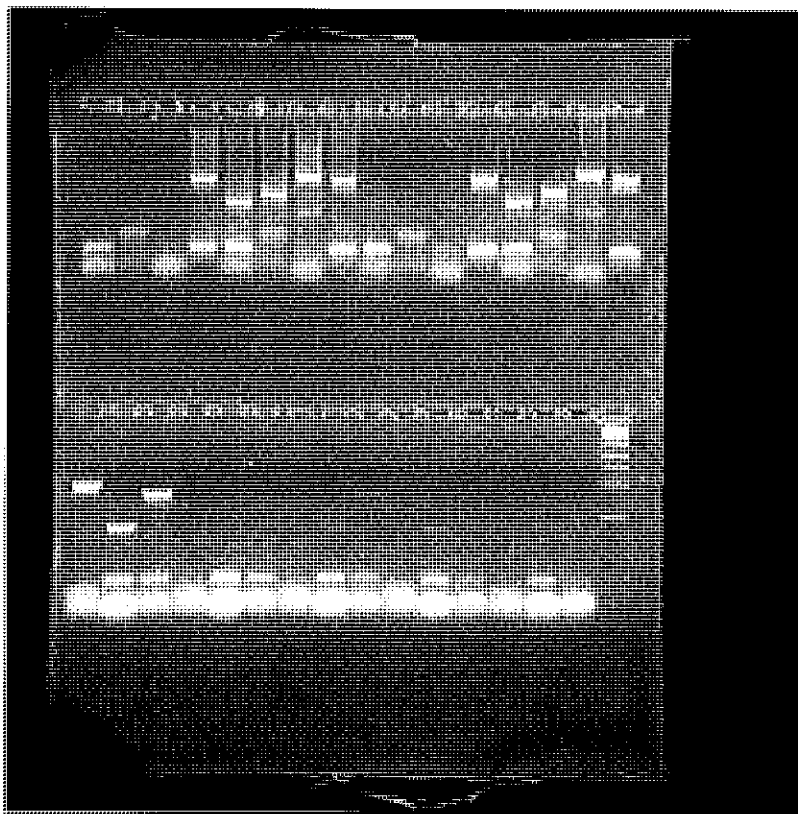
Califorensics searched the hard drive images for files containing images resembling those used in Paper 8. They located what appeared to be three nearly identical images (named bon.bip, bon2.bip and bon3.bip) on the Gel Imaging Station. Each image appeared to be from the same material with the same lanes and same artifacts. The only observable differences were minor contrast and brightness variations, and bon was the most in focus followed by bon3 then bon2. These images were in the .bip format, the original format produced by Kodak Imaging (now Carestream Imaging) lab devices.

[redacted] confirmed that the named images were the ones he saved, copied to a usb drive and moved to the Sauer lab computer as part of the research used in the paper.

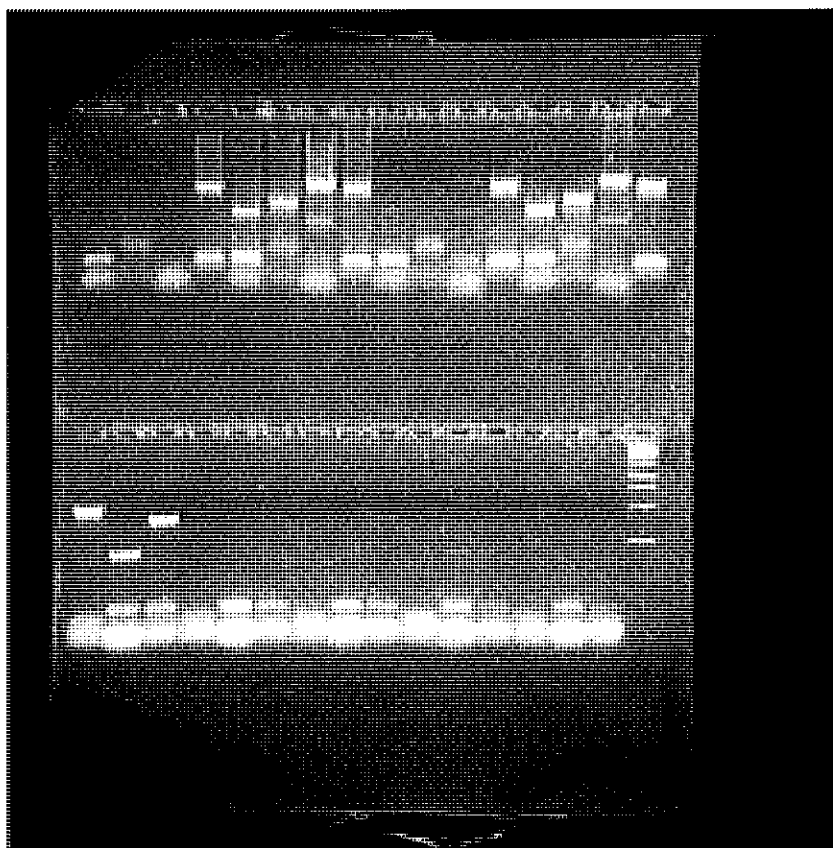
A review of the Gel Imaging computer by Califorensics revealed no software for editing images on that computer. It is thus not likely the original images were edited on this computer. A forensic review of the metadata regarding those files revealed the images had all been created and last modified on 7/28/2010 at approximately 6:06 PM to 6:07 PM. Each image had a different hash value (digital fingerprint), meaning that each image differed in some way (which Califorensics noted was largely the focus during the

capture). Calforensics converted the .bip files to jpg for analysis. The following are the three images from the Gel Imaging computer.

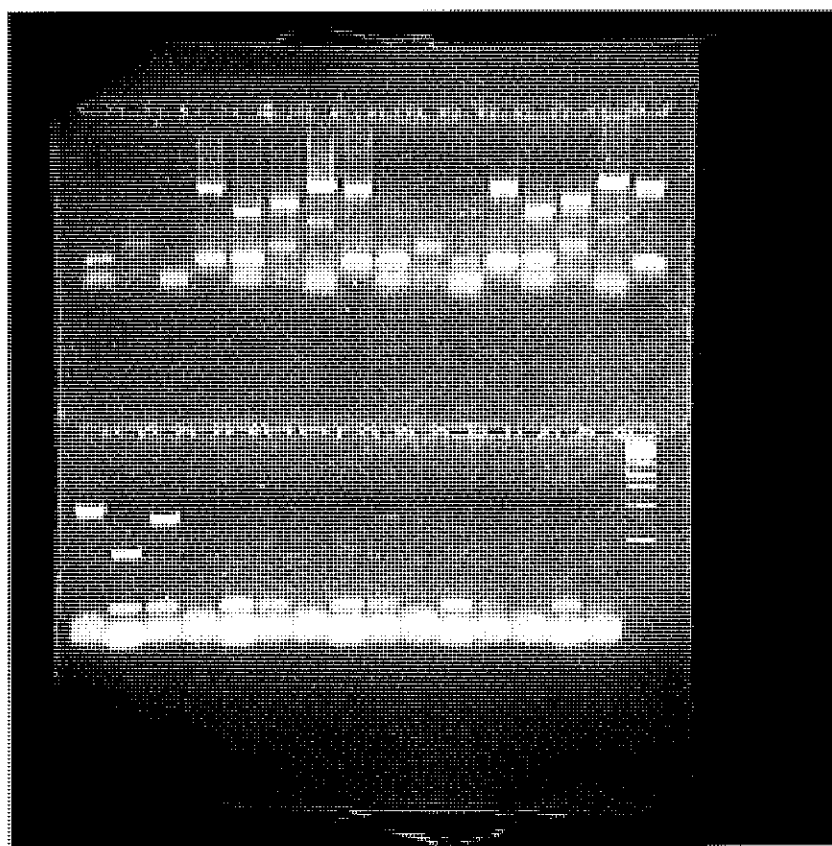
Bon.bip (From Gel Imaging Station)
7/28/2010 6:06 PM



Bon2.bip (From Gel Imaging Station)
7/28/2010 6:07 PM

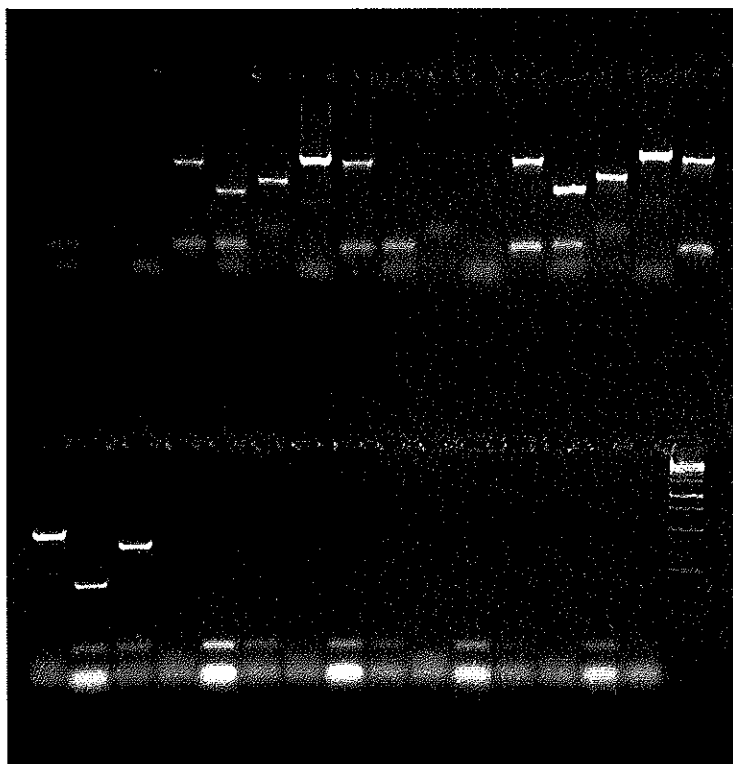


Bon3.bip (From Gel Imaging Station)
7/28/2010 6:07 PM



Califorensics next located on the Big Mac computer located in the lab group area two jpeg images named bon2 and bon3. The metadata for these files revealed they had been last modified on 7/29/2010, the day after they had been created on the imaging machine. A comparison of the bon2.bip original image from the Gel Imaging machine (bon2 original) with the bon2.jpg located on the Big Mac computer from the lab group area revealed the two to contain identical content. Califorensics reached this conclusion based upon an examination of the image detail, as well as a comparison of image artifacts that appear as specks on the image. They also appeared to be of similar quality in terms of focus. The bon2.jpg appeared to be a cropped version of the original, removing only the outlying portions of the image that showed the edge of the film. The bon2.jpg appeared to also have been adjusted for brightness and contrast, being darker and having more contrast than the bon2 original. The bon2.jpg had a brightness of 22% while the bon2 original had a brightness of 55% and slightly more red tone than the bon2.jpg.

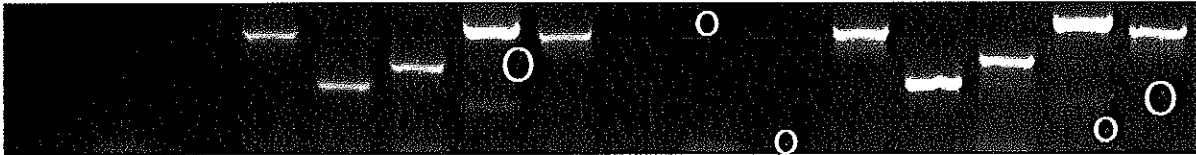
Bon2.jpg (From Big Mac in lab area)
7/29/2010 4:30 PM



Califorensics located 11 versions of the "bon" images on Dr. Sauer's laptop drive. A review of the hash values for these images revealed all but one were identical to the bon2 and bon3 images from the Big Mac computer in the lab group area. The one image that differed was an Adobe Photoshop image named bon3.psd on the laptop used by Dr. Sauer. This image appeared to be a greatly cropped version of the above

discussed bon2 and bon3 images. Calforensics examined the psd file for a record of adjustments made and did not locate such history, suggesting it had likely been saved as a new psd file during editing. Through their own observations of the psd image, Calforensics determined that it had the identical brightness of the bon2.jpg. A comparison with the original bon2 image revealed image artifacts suggesting the psd file likely originated from the original bon2 image (see the psd image below for an illustration of some of the artifacts observed on both images). A comparison of this image with one published in Paper 8 revealed they appear the same in terms of the lanes in the DNA electrophoresis.

Bon.psd (From Sauer laptop)



Based upon the above observations, Calforensics concluded that the original bon.bip image was converted to a jpeg image and later to a Photoshop document on Dr. Sauer's laptop. The resulting image published in *Molecular Cell* was of a greater contrast than the Sauer lab images but contained the same DNA electrophoresis in all lanes as the original image.

Allegation 11: Investigation Committee Conclusions

No further investigation of this is required because the original data has been identified and the allegation is dismissed.

Conclusions

Research records

This report has identified multiple instances of falsification and fabrication of data in papers published by Dr. Frank Sauer's laboratory over a period spanning ten years (see Table 3 for summary of these instances); the only author listed in common on all these papers (and the 2005 manuscript submitted to *Nature* – Allegation 13) over this time period was Dr. Frank Sauer. While the Committee considered the materials that Dr. Sauer only brought to the Committee's attention during his interview on May 25, 2012 (**Appendix 23**), these data had not been provided to the RIO, Dr. Louis, as requested on October 13, 2011, which was in direct conflict with Section V1. C.3 of UCR's *Policy and Procedures for Responding to Allegations of Research Misconduct*. Dr. Sauer had been handed a copy of this policy when he was interviewed by the RIO on October 13, 2011 when the RIO requested of Dr. Sauer that he provide the RIO that day with all research records related to the eight papers that were alleged to contain falsified and fabricated figures. Because these materials that were finally provided to the ORI on 6/18/12 (**Appendix 23**) had not been provided to the RIO Dr. Louis, as requested on October 13, 2011, and therefore were not sequestered, there was no assurance that these figures were actually associated with these papers. Thus, the Committee was not persuaded that these materials supported Dr. Sauer's position. Finally it should be noted that most of these items in **Appendix 23** were secondary Illustrator or Photoshop files and not the original TIFF, JPEG or machine generated original images so it was not possible to confirm that these images were original and had not been modified or manipulated in some way.

The credibility of these materials provided to ORI on 6/18/12 was further questioned because of a communication from Dr. Sauer's attorney on August 13, 2012 (**Appendix 26**) that attached a letter purported to have been written to Dr. Sauer by Dr. Guy Riddihough, an editor of *Science* about the Pham and Sauer, 2000 *Science* manuscript (Paper 4); Dr. Sauer's attorney noted that "This correspondence is also relevant to the Maile et al, 2004 *Science* paper." This letter was purported to have been written to Dr. Sauer when he was still in Heidelberg in 2000, yet the letter provided is dated 31 July, 2012. Clearly this letter is a fabrication as a letter from the journal *Science* regarding the manuscript for Paper 4 would have to have been written prior to the date of publication of this article on 29 September 2000. This provides further evidence of Dr. Sauer's recklessness in his management of his research-related materials.

Appearance of gel bands

In many of the misconduct findings in this report, gel bands appear to be in a box with very straight edges. Indeed *Science* magazine had noted this first and indicated that this suggested inappropriate manipulation of data (**Appendix 7**). To further understand whether this would occur naturally the Committee interviewed [redacted] who had been a co-author and colleague of Dr. Sauer when they were both postdoctoral fellows at UC Berkeley in the late 1990s (with different advisers). Dr. [redacted] was consulted because he teaches a course for undergraduates at the University of Wisconsin entitled "Entering Research" that reviews all the aspects of

research including keeping notebooks, preparing publications etc. stated that gel bands appearing to be in a box with very straight edges "would not occur naturally" (p. 44 interview transcript **Appendix 15**). Thus, Dr. statement supports the Committee's findings of research misconduct resulting from data fabrication and falsification as discussed above.

Preparation of images for submission to journals

Based on the statements made by Dr. Frank Sauer and all the witnesses interviewed by the Committee it is clear that the final assembly of all figures and their preparation for submission to the journals was done by Dr. Frank Sauer alone (**Appendix 15**). The practice was for his lab staff to provide Dr. Sauer with several replicates of the experiments from which Dr. Sauer would choose the images to be used in the final figure (e.g. p. 29 interview).

Regarding the preparation of figures, stated on 5/10/12 that Frank Sauer was the primary person for preparing figures for submission to the journal (p. 13). When was questioned as to whether he could have given Dr. Sauer the wrong image for a figure he commented that "in my experience I never mixed up one" (p. 26) and that to avoid this possibility he "always put the date into the title" of each image file (p. 27).

stated that in response to the question "who did the final figure preparation for submitting manuscripts for the journal" stated "That was Dr. Sauer" and "Frank was preparing the pictures for the publication" (p. 9).

Similarly, stated that "So that once we had them, the figure, for example DNA gel, we would scan them and we would give it to Frank" (p. 13), affirming the question that "you and the other people took original images and then those images were handed to Frank for the final preparation ... from being moved from being images to figures" (p. 13). commented that he (Dr. Sauer) then showed the final figures to the scientist who had conducted the experiment (p. 14). Since the manipulation of images could only be detected by changing contrast and enhancing the size of the images it would have been difficult to detect any manipulation of the images by the scientist who had conducted the experiment.

also confirmed Dr. Sauer's role in preparing the figures stating that "Final figures, this is something Frank prepared.", "he prepared the figures and wrote the manuscripts" (p. 8). Indeed this former graduate student of Dr. Sauer stated that "I was surprised how clean some of the results looked" in the Nature Paper 6 on which Dr. was first author (p. 10). For experiments conducted by Dr. Sauer for this paper, questioned how Dr. Sauer had got one of the enzymes to work as in Dr. hands this enzyme (Ash 1) was a "very lousy enzyme which had its activity but very low" (p. 11). Thus the first author of this paper was questioning the appearance and actual data in the published manuscript. When he raised this concern with Dr. Sauer he did not get a satisfactory explanation as to how Dr. Sauer had got this enzyme to work.

Management of laboratory notebooks

When the RIO first met with Dr. Sauer on October 13, 2011 to sequester all materials relating to the allegations, neither [redacted] who was there that day, nor Dr. Sauer were able to locate [redacted] notebooks – they searched at length for these but were unable to find them. These notebooks related to the *Molecular Cell* Paper 8 of which [redacted] was first author. It was clear that this was the first time that they were aware that these note books had been misplaced. During the May 25, 2012 interview Dr. Sauer stated that these notebooks and those of [redacted] (an earlier graduate student) had been stolen earlier that summer of 2011 but that were only noticed as being lost on October 13, 2011. Surprisingly this theft had not been reported to the police department as had a prior theft of computers from Dr. Sauer's laboratory in 2003; certainly Dr. Sauer did not mention that his inability to find [redacted] notebooks on October 13, 2011 was because of a theft earlier that summer – he said they must have been misplaced. This contradiction as to the explanation for the loss of these notebooks on these two dates raised concerns with the Committee that Dr. Sauer did not maintain good oversight of the laboratory notebooks of his former students.

That Dr. Sauer did not maintain careful oversight of the notebooks of the students in his laboratory was further exemplified in an interview with another of his former graduate students, [redacted] on May 10, 2012 when [redacted] told the Committee that he had taken all his laboratory notebooks with him when he left the laboratory which is contrary to accepted practices and University of California policy as the notebooks belong to the University of California and not the individual investigator. The RIO requested he send these notebooks to him (the RIO) which [redacted] did. These comprised ten (10) notebooks.

In terms of the operation of the Sauer laboratory it is clear that all his employees reported directly to Dr. Sauer and that he rarely if ever held laboratory meetings where the different lab members presented their data. This was confirmed by several of the witnesses interviewed by the Committee. For example, [redacted] stated that "We really didn't have any real lab meetings. He would just like, each individual, if he had a question, you would go to him." (p. 9), and had this "one-on-one system" (p. 19). [redacted] explained it as "we interacted with Frank, but not with other people" (p. 14) and "we tried to establish that (a lab group meeting) but that was very hard with Frank (p. 15)".

Summary

Based on the extensive interviews with witnesses and Dr. Sauer, analyses conducted by the journals and consultants, and analyses of the laboratory materials and digital files provided by Dr. Sauer, the Committee concluded that Dr. Sauer alone was responsible for these multiple instances of research misconduct in which he falsified and fabricated research data. The evidence established a pattern of research misconduct, the Committee's conclusions met the applicable evidentiary standard, i.e., a preponderance of the evidence, and the Committee concluded that these instances of research misconduct were a significant departure from accepted practices of Dr. Sauer's research community. They constituted at a minimum recklessness, and in some

instances, due to the nature of the manipulation, the Committee found that the research misconduct was committed intentionally and knowingly.

The UC Riverside *Policy and Procedures for Responding to Allegations of Research Misconduct* Section VII.F.3 requires the Investigation Committee to offer its recommendations with respect to disciplinary sanctions. The Committee made the following listing of suggested disciplinary actions:

- That Dr. Sauer be ineligible to submit articles for publications or apply for sponsored funding for a period of five years.
- That Dr. Sauer be ineligible for any merit increase for five years.
- That Dr. Sauer's step advancement be reduced.
- That Dr. Sauer be ineligible to supervise any graduate student or postdoctoral fellow for five years.
- That Dr. Sauer be required to attend a workshop in "training the trainers" in research ethics and demonstrate a comprehension of the material. Dr. Sauer will subsequently be required to direct a research ethics course at UCR for a minimum of three years.
- That Dr. Sauer be required to have his research supervised for a period of five years by a committee appointed by the Vice Chancellor for Research.
- That following the period when he is ineligible to submit articles for publications or apply for sponsored funding Dr. Sauer be required to have all manuscripts and grant applications reviewed by the supervisory committee for a period of three to five years.
- That Dr. Sauer provide letters of apology to the relevant journals indicating the figures that the Investigation Committee found to be falsified and/or fabricated.

Investigation Report Appendix Materials

- Appendix 1: Allegations e-mail received 10/3/11
- Appendix 2: Eight papers (plus supplements) that were the subject of the allegations.
- Appendix 3: Listing of all the proposals and awards of Dr. Frank Sauer while at UC Riverside.
- Appendix 4: Charge to the Inquiry Committee 10/12/11.
- Appendix 5: Summary of evidence materials identified by Dr. Frank Sauer 10/19/11 – 10/20/11.
- Appendix 6: *Nature* forensics analysis received 11/9/11
- Appendix 7: 2 CDs containing the images received from *Science* on 11/18/11 (7-1) and 2/13/12 (7-2).
- Appendix 8: 12 CDs received from Dr. Sauer on 11/17/11 contained images and original data that he identified as having been used for the figures referred to in the Allegations in Appendix 1.
- Appendix 9: Summary provided by Dr. Frank Sauer 12-13-11 of a catalog with the name of the specific CD and the name of each folder and file on that CD that contained the original data (i.e. the original blots/gels images) for the figures that were the subject of the allegations.
- Appendix 10: UC Riverside Inquiry Report submitted to Dr. Sauer 12/23/11.
- Appendix 11: Letter from Dr. Sauer in response to the Inquiry Report.
- Appendix 12: UC Riverside Inquiry Report submitted to the Office of Research Integrity at PHS.
- Appendix 13: UC Riverside Inquiry Report submitted to the Office of the Inspector General at the National Science Foundation.
- Appendix 14: Charge to the Investigation Committee 2/1/12.
- Appendix 15: Transcripts of the interviews with the eight witnesses and Dr. Frank Sauer.
- Appendix 16: Forensics analysis report prepared by Calforensics of Roseville, California.

- Appendix 17: Instructions for journal authors regarding preparation of digital images for submission of manuscripts.
- Appendix 18: Slide Set Analysis of Evidence developed by the Investigation Committee.
- Appendix 19: Evidence Log of materials sequestered from Dr. Sauer's laboratory on 10/13/11.
- Appendix 20: 5/25/12 letter from Dr. Louis to Erik Wolf, attorney for Dr. Frank Sauer.
- Appendix 21: 6/6/12 letter from Dr. Louis to Erik Wolf, attorney for Dr. Frank Sauer.
- Appendix 22: 6/18/12 letter from Erik Wolf, attorney for Dr. Frank Sauer to Dr. Shara Kabak at ORI listing the evidence he provided her.
- Appendix 23: Folder containing copies of the 162 Items sent to ORI by Erick Wolf on 6/18/12.
- Appendix 24: 2005 Manuscript and reviews provided by *Nature* entitled "Role of TAF1-mediated mono-ubiquitination of histone H1 in transcriptional activation" by [redacted] and Frank Sauer.
- Appendix 25: Paper provided by [redacted] as an example of how gel lanes from different experiments should be presented when included in a single figure panel.
- Appendix 26: August 13, 2012 letter from Erik Wolf with attached letter from *Science* to Dr. Sauer dated 31 July, 2012 regarding the 2000 Paper 4.
- Appendix 27: October 5, 2012 response from Dr. Frank Sauer to the Draft Investigation Report.
- Appendix 28: Investigation Committee Review of Dr. Frank Sauer's October 5, 2012 Response to the Investigation Report

* Note for Appendix 15 (Frank Sauer transcript): There is a disagreement with Dr. Frank Sauer's edits as to what the audio file recorded in several places when compared with the transcript received from the transcription service. Both the transcript received from the transcription service (file name: Frank Sauer 5-25-12 Transcript.pdf) and the edited version of that received from Dr. Sauer (file name: Frank Sauer Transcript – With FS Edits.pdf) are provided here as is the audio MP3 file from which the transcript was derived. After careful review of the audio of this interview, the following editing changes were made by Dr. Sauer that, in the Investigation Committee's view, were not on the audio file and changed meaning. These changes were:

p. 21 line 23 – “he went into the journal” was changed to “it would not have went into the journal,” which significantly changes the meaning of the phrase.
p. 40, line 13 – “that” is changed to “a,” which alters the meaning.
p. 42, line 4 – “March” is changed to “hmmm” which also alters the meaning.
p.78, line 1 – deleted “a,” which minimizes the impact of the statement.

All other transcripts had been reviewed by the interviewees, their edits were accepted, and then incorporated into the final transcripts provided here.