

Publish sound science:  
Educating authors on the value of  
Image integrity in Scholarly  
Publishing

Aashi Chaturvedi, Ph.D  
Senior Ethics Specialist,  
American Society for Microbiology

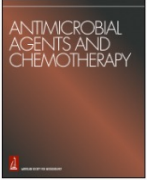







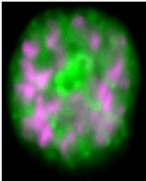

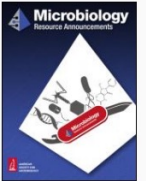



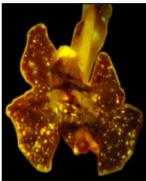

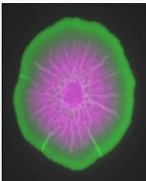




10/13/2023  
13th GW Ethics in Publishing Conference



AMERICAN  
SOCIETY FOR  
MICROBIOLOGY



# ASM Journals publishes in all areas of Microbiology

	Antimicrobial Agents and Chemotherapy		Applied and Environmental Microbiology		Infection and Immunity
	Journal of Bacteriology		Journal of Clinical Microbiology		 Open Access Journal of Microbiology & Biology Education
	Journal of Virology		 Open Access mBio		 Open Access Microbiology Resource Announcements
	 Open Access Microbiology Spectrum		 Open Access mSphere		 Open Access mSystems
	Clinical Microbiology Reviews		EcoSal Plus		Microbiology and Molecular Biology Reviews

## Discipline Specific

*Journal of Bacteriology* (General microbiology)

*Journal of Virology* (Basic and applied virology)

*Infection and Immunity* (Microbe and host)

*Applied and Environmental Microbiology* (Microbe and environment)

## Clinical Focus

*Antimicrobial Agents and Chemotherapy* (Therapeutic)

*Journal of Clinical Microbiology* (Diagnostic)

## Open Access

*mBio* (Highly-selective)

*mSphere* (Broad community)

*mSystems* (Microbes and systems)

*Journal of Microbiology and Biology Education* (Teaching microbiology)

*Microbiology Resource Announcements* (Genomic and proteomic data)

*Microbiology Spectrum* (Sound science)

## Reviews

*Clinical Microbiology Reviews*

*Microbiology and Molecular Biology Reviews*

*EcoSal Plus* (*E. coli*, *Salmonella*, and other Enterobacterales)

# Hallmarks of Sound Science

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## Reliability

- Is the data original, robust and **trustworthy**?

## Reproducibility

- Can the **same data** be regenerated with the same set of materials and methods?

## Replicability

- Across different studies through **independent experiments/approaches** can the results be consistent?



# Image Integrity in Scholarly Publishing



# Image Screening at ASM

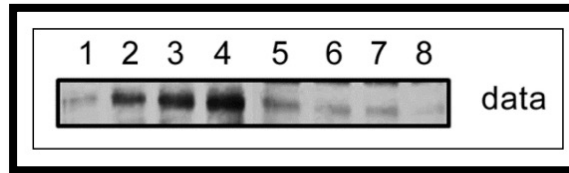
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All accepted manuscripts are routinely prescreened to ensure that all images are free from any integrity issues.



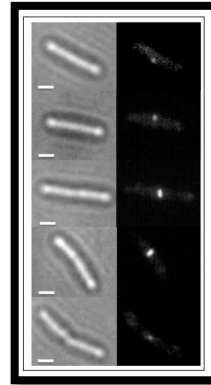
# Image Screening at ASM: Common image integrity issues

## Unacknowledged splicing



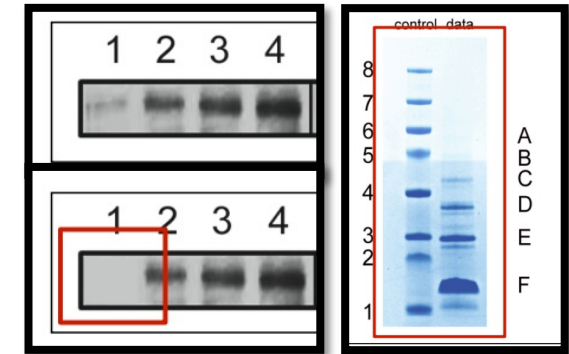
- Examine faint discontinuities
- Erasures
- Background noise

## Image stitching, mosaics etc.



- Examine margins, edges

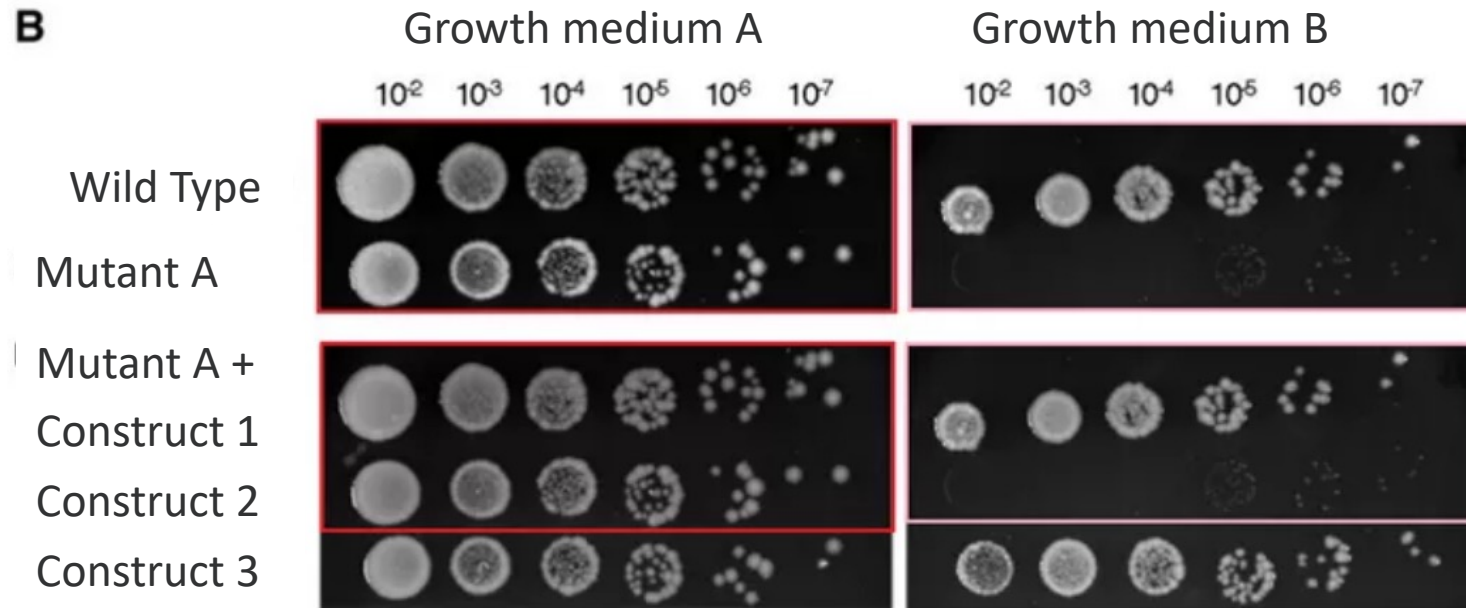
## Non uniform image enhancements



- Detect adjustments to backgrounds or removal of elements in images
- Color comparison of grayscale images



# Forensic Screening at ASM



# Proactively screening for image duplications pre-publication

- In a study of >20,000 research articles ~4% of these papers were found to include at least one figure containing potential inappropriate duplications. (Bik et.al, mbio.00809-16).
- What new tools are available for screening manuscripts and articles for image duplication events?
- We found a possible tool with **ImageTwin** and we began our pilot study incorporating this tool in our workflow in January 2023 with a single Journal title.





# A little bit about ImageTwin

Disclaimer: ASM is not endorsing ImageTwin,  
but sharing its experience with the software.

# ImageTwin detects 'potential' image duplications

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<https://imagetwin.ai/>

- 2022 tech start-up out of Vienna, Austria.
- Uses AI-based algorithms to detect integrity issues in figures of scientific articles.
- ImageTwin can detect potential inappropriate image duplication in many figure types:
  - Gels and blots
  - Microscopy images
  - Light photography
- ImageTwin can detect duplications:
  - Within a manuscript
  - Across articles (open access)
- ASM expanded its pilot program to include all Journal titles in March 2023 until August 2023.

# All accepted manuscripts additionally scanned using ImageTwin

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## Scan

- Each accepted manuscript is scanned as a single file.
- Revised files provided by authors are a second scan.

## Review

- Independent confirmation of each potential duplicate by Image Specialist.
- Additional confirmation using Adobe Difference Function.

## Report

- ImageTwin generates a report with duplicates noted.
- Adobe Difference report is generated by Image Specialist and shared with Authors.



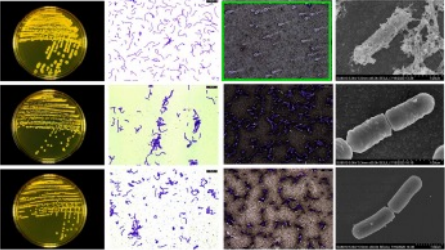
# ImageTwin Report

## Imagetwin™ Scan Report

Created on	2023-02-05 15:16 UTC
Duplicates	1
Images	2
<b>Manuscript #</b>	1 Duplicate

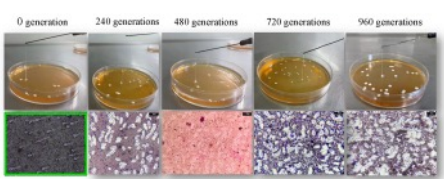
**Full Image**

**Manuscript # Figure #2**

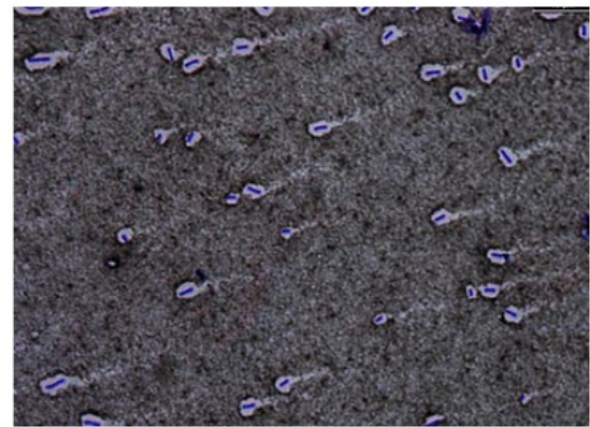


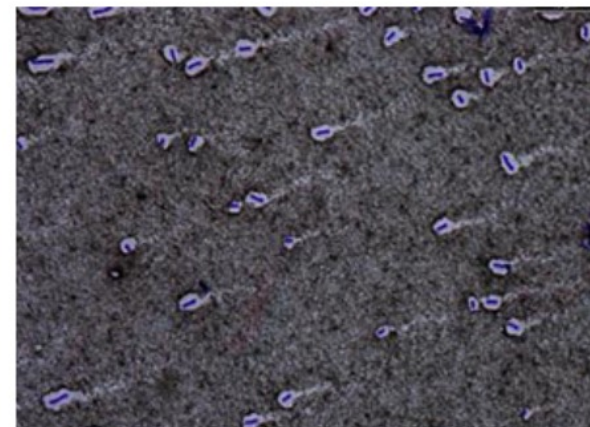
**Manuscript # Figure #7**

a

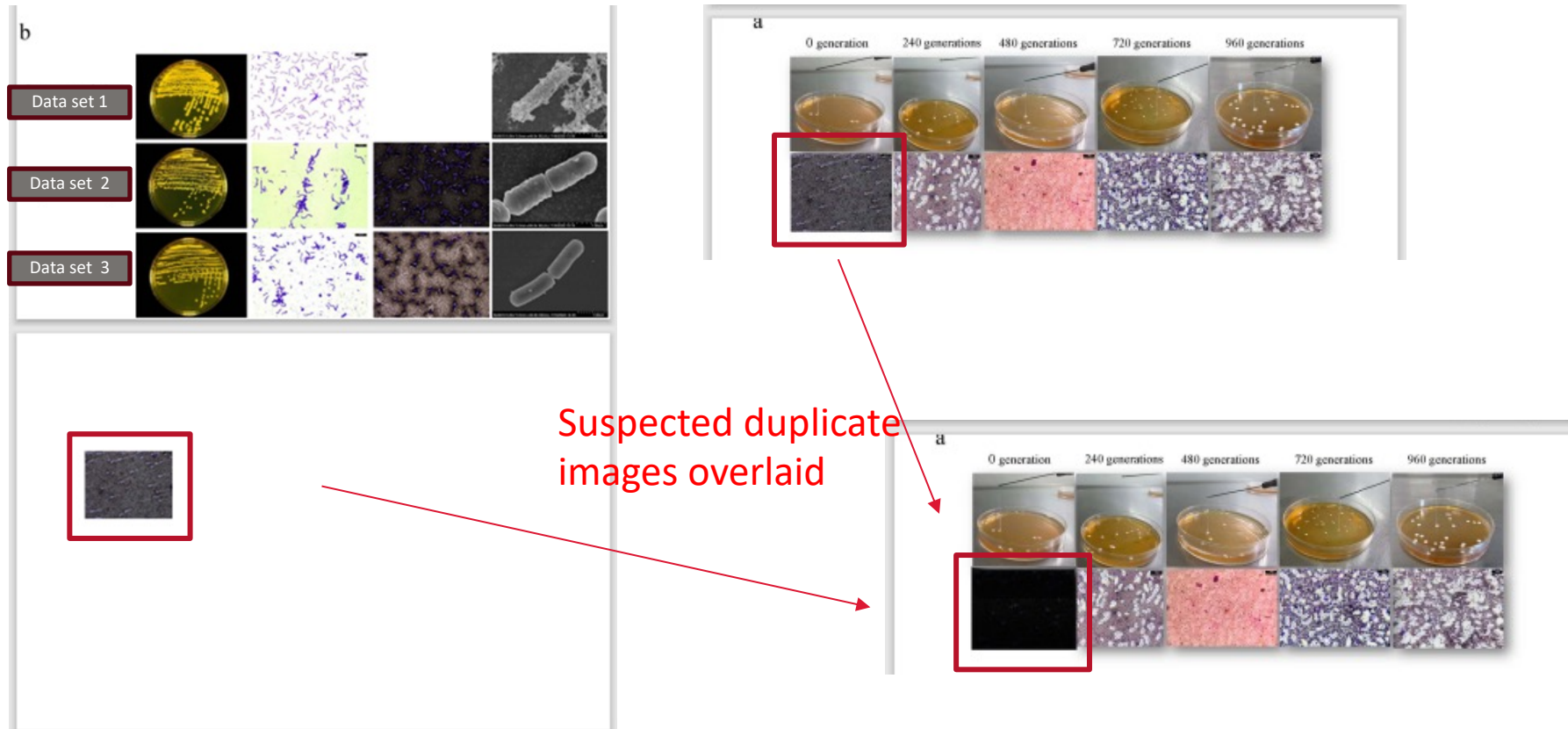


**Duplicated Area**



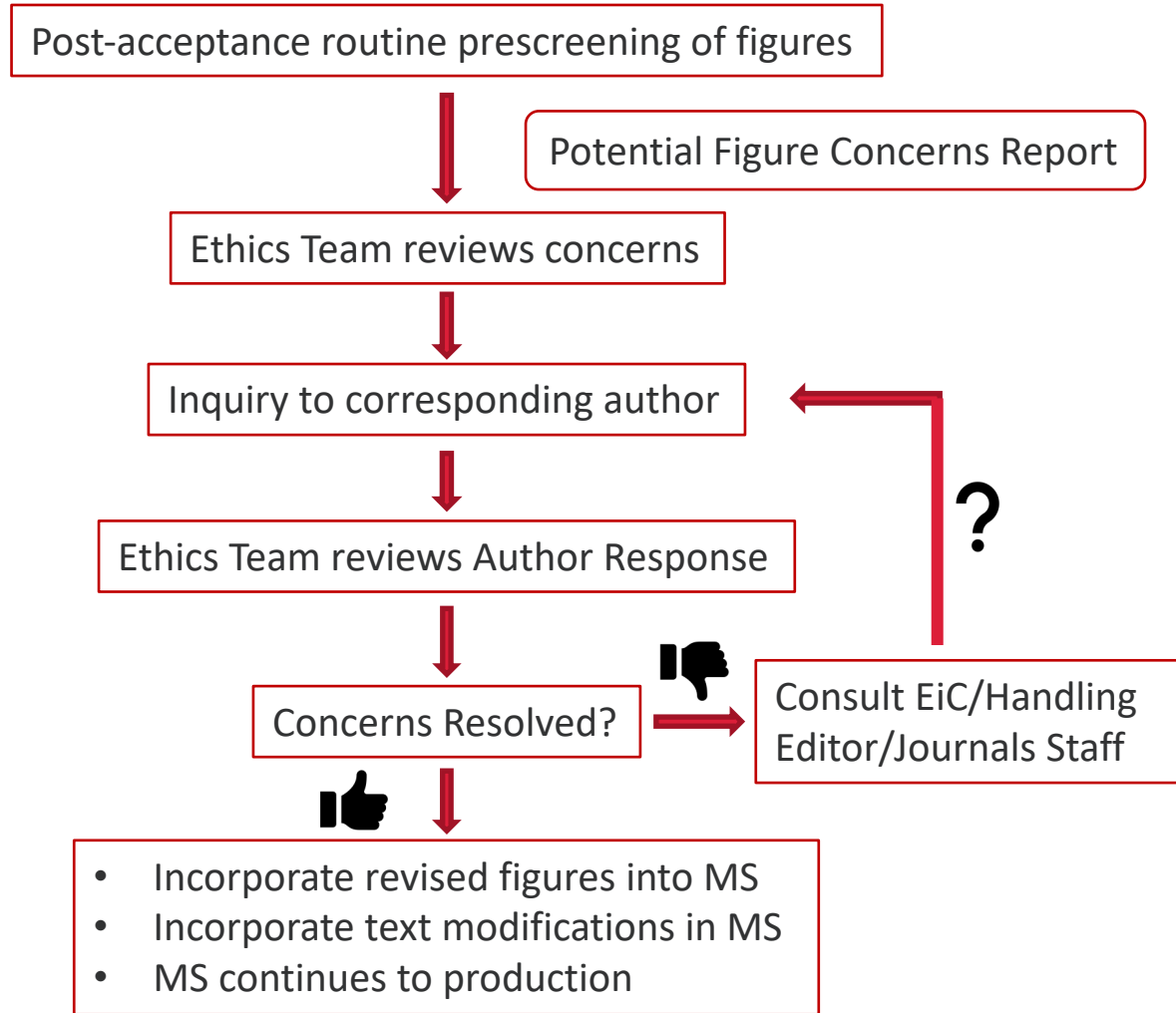


# Adobe Difference provides independent confirmation



Resulting image is completely black confirming the likely duplication.

# Process to address figure concerns

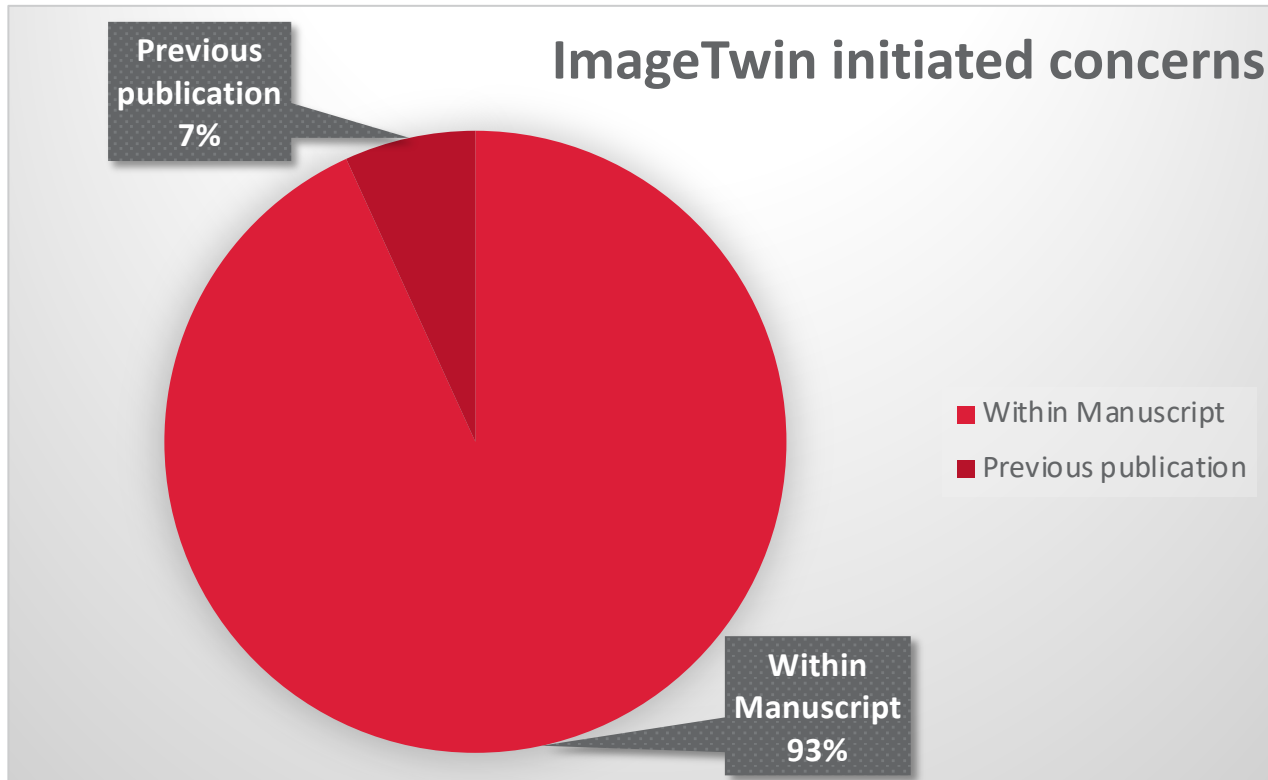




# Lessons learned- Part I: Image Twin pilot 'successful'.



# ImageTwin Pilot Results



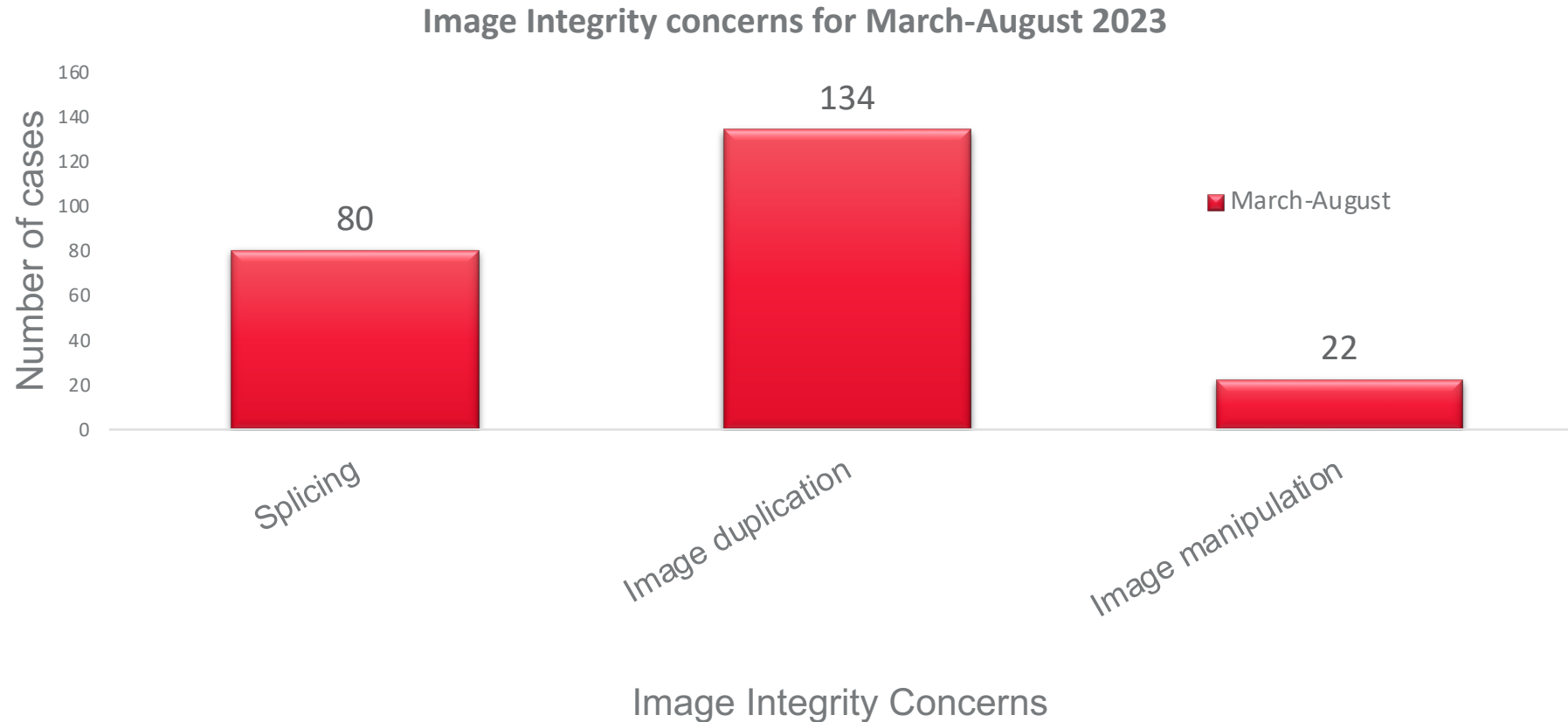
**Note:** This data represents concerns from 03/01-08/31/2023.

- ImageTwin was expanded to all Journal titles from March 1<sup>st</sup>, 2023.
- 3298 manuscripts were accepted during this time.
- 134 confirmed image duplication concerns were identified by ImageTwin.
- Therefore, 4% of manuscripts had image duplication concerns.



# Over 50% of image integrity concerns were image duplication concerns

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**Note:** This data represents concerns from 03/01-08/31/2023.

# Primary reasons for image duplications in manuscripts

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- “It was an honest mistake.”
  - copy-paste error while making/assembling figures,
  - Too many panels in the figure,
  - placeholder images,
  - file names were too similar,
  - multiple versions of manuscript, etc.
- “It was part of a large experiment, so portions of data such as control set are similar.”
- “We were unaware we needed to declare image reuse or get permission.”
  - “Can we not reuse if it is our own data?”

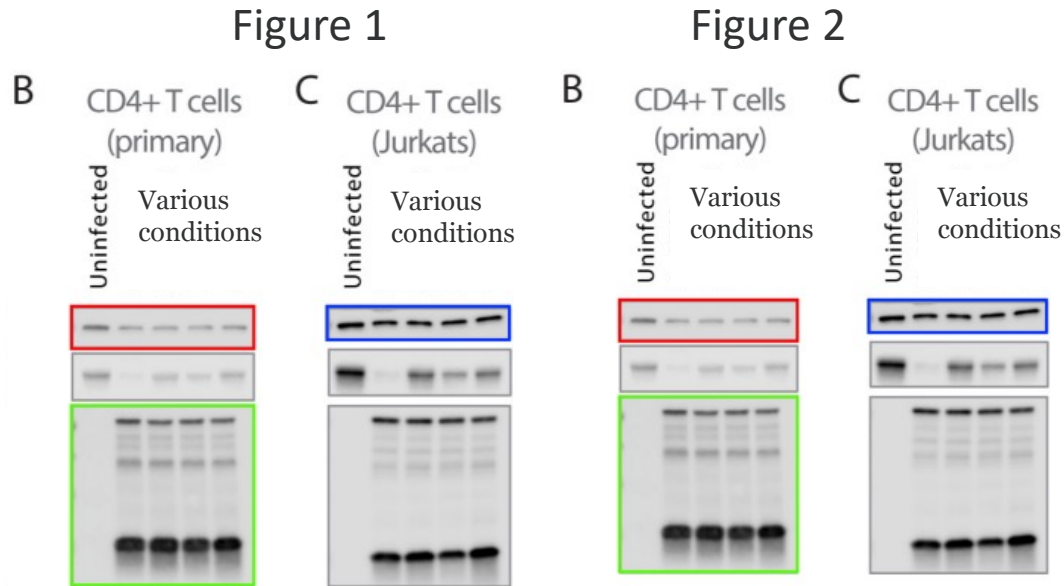


# Lessons learned- Part II: Resolutions can be straightforward.



# Some concerns could be addressed through attribution in the legend.

## Example 1



If image reuse is necessary for clarity and data presentation, it should be acknowledged in the figure legend, such as: “*Note that T cell experiments are the same as those in Figure 1b and 1c, therefore control blots are reproduced.*”

## Example 2

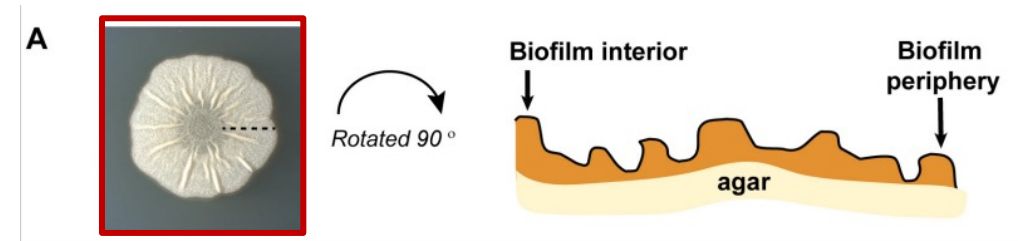
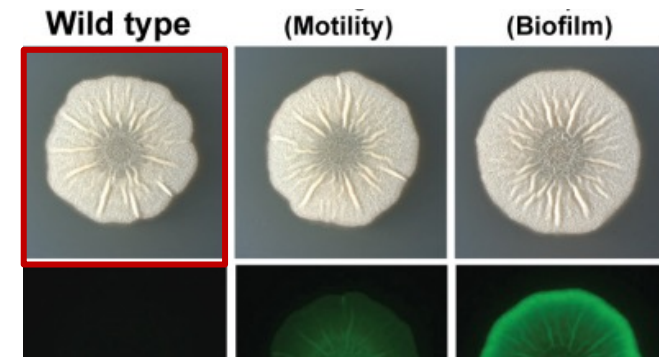


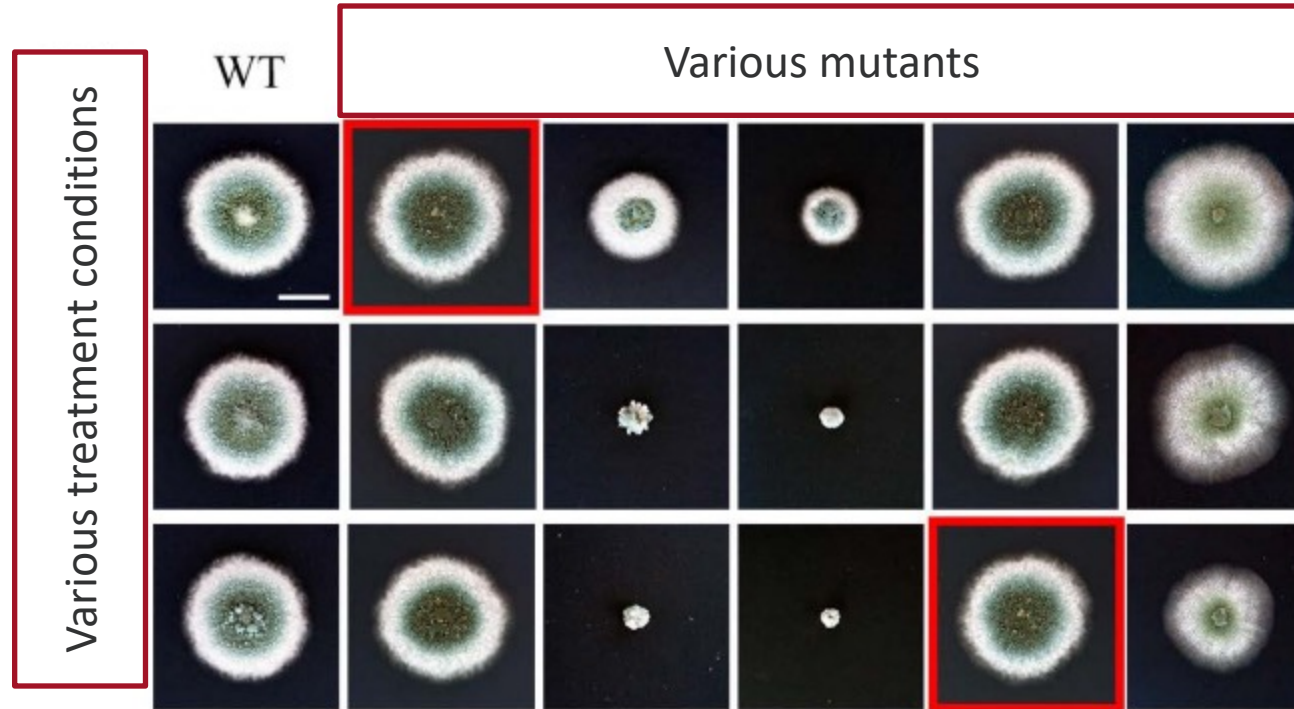
Image reused in schematic

Acknowledgement in Figure legend notes that image in the schematic is a representative image



# Some concerns could be addressed by revising the figures.

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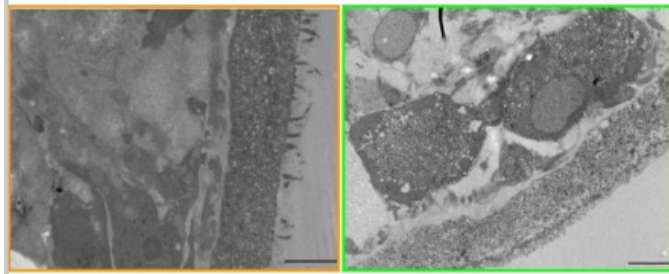


Assemble multi-panel figures carefully.  
Verify each panel through different stages of publication.

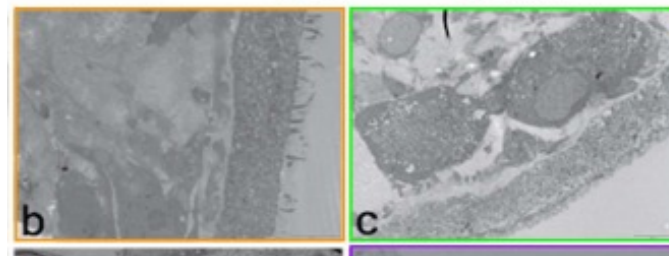
# Addressing “image-reuse” concerns with a published article

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Published image from previous article



Images included in the ASM manuscript

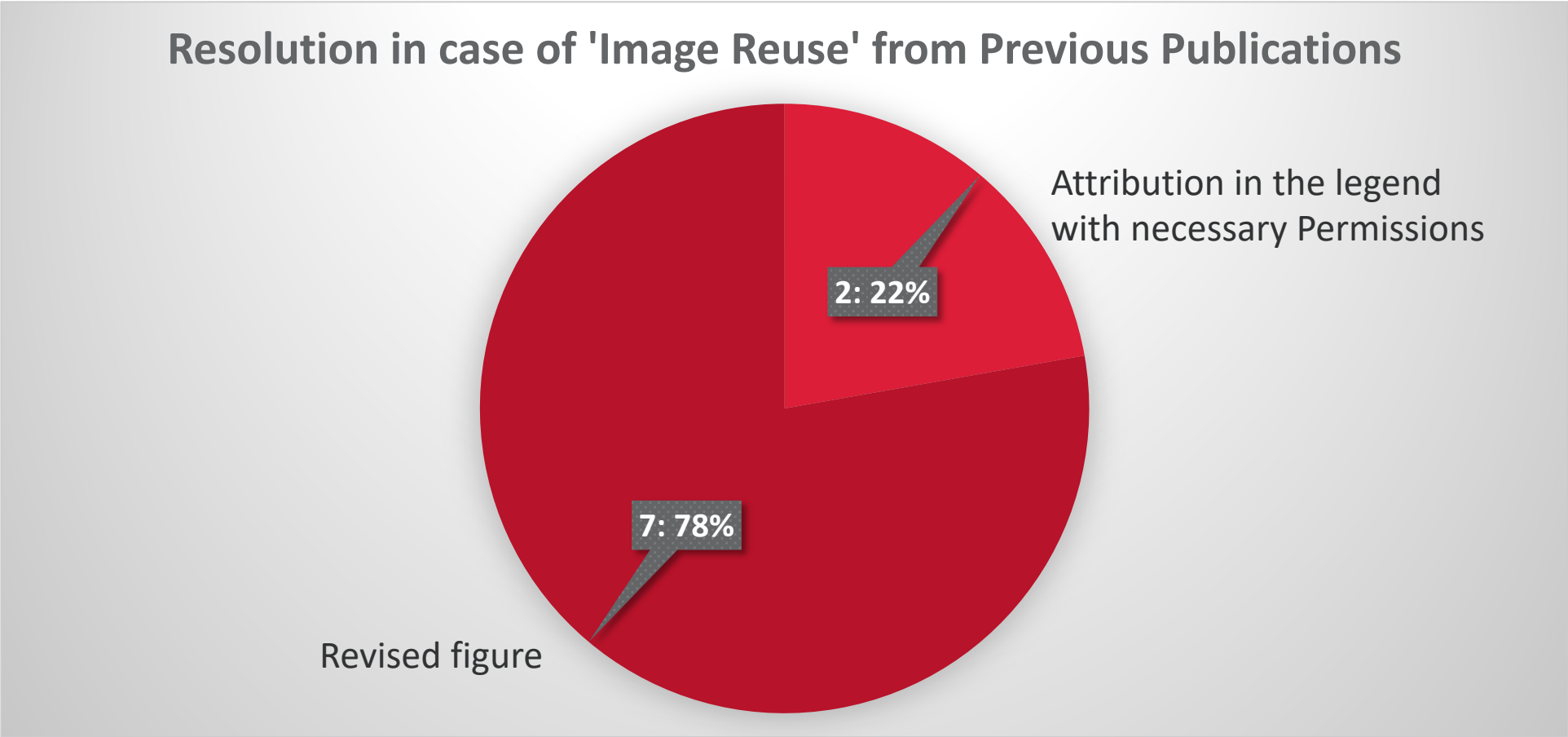


In the event that the authors' previously published figures and/or data are included in a submitted manuscript, it is incumbent upon the corresponding author to:

- (i) identify & acknowledge the source on the submission form,
- (ii) obtain permission from the original publisher (i.e., copyright owner),
- (iii) acknowledge the duplication in the figure legend,
- (iv) cite the original article.

<https://journals.asm.org/duplicate-publications>

# Resolutions for image duplication with previously published articles in ASM or non-ASM journals

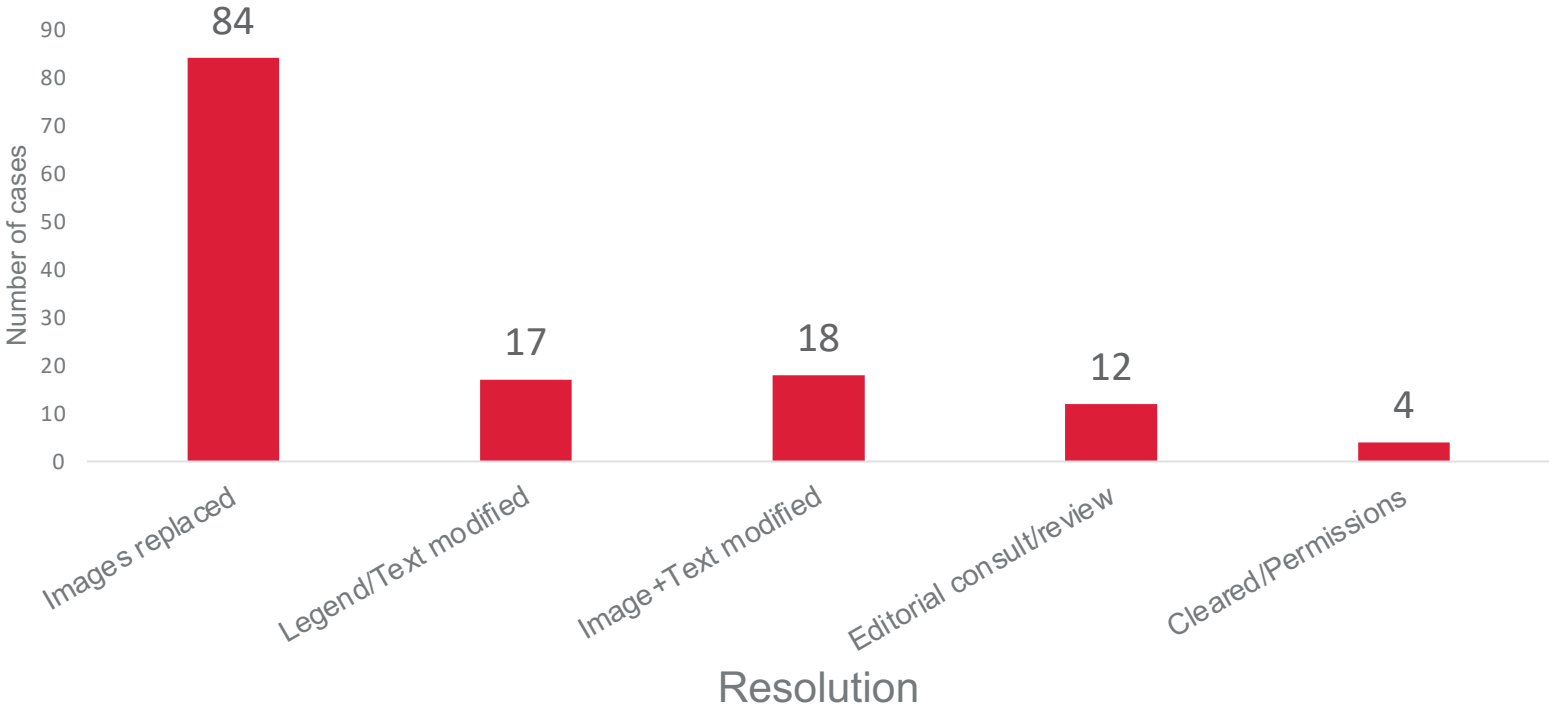


**Note:** 9 out of 134 cases confirmed instances of image reuse from a previously published article

Lessons learned- Part  
III:  
Resolutions can be  
complicated.

# Editorial consults requested in ~9% of image duplication cases

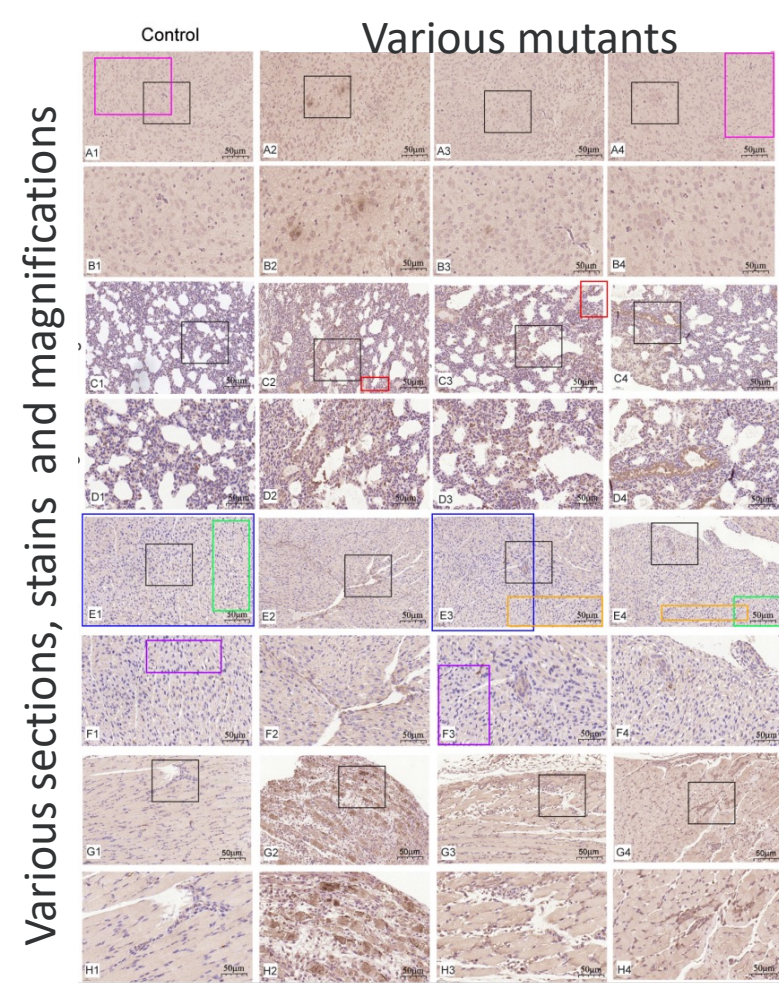
Overview of actions taken towards resolution



**Note:** Editorial consults in 12 manuscripts may skew the total above.

# Primary reasons for editorial consults in manuscripts

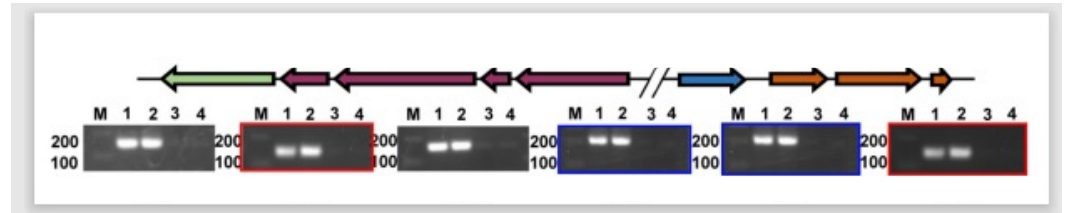
- Multiple duplication events within figures or across figures.
  - Duplication events with other manipulations like image rotation, resizing, flipping, adjustments to brightness/contrast etc.
- Inability of the author to provide original, unmodified raw underlying data.
  - Original data provided does not match data in the figures.
  - Inability to access data from collaborator.
  - Not providing sufficient explanation.



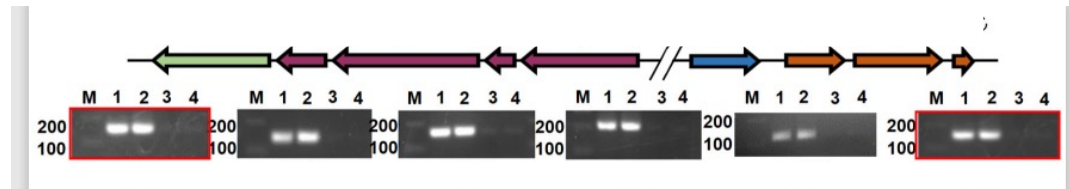


# Primary reasons for editorial consults in manuscripts

- Data provided from replicate experiments (old or new) that have not been peer-reviewed before.
  - Revised images bring up new concerns.
  - Suggestion to repeat an entirely new internally controlled experiment.
  - Suggestion to ‘delete’ problematic panels from the figure.
- Inability to provide necessary permissions to reuse data.

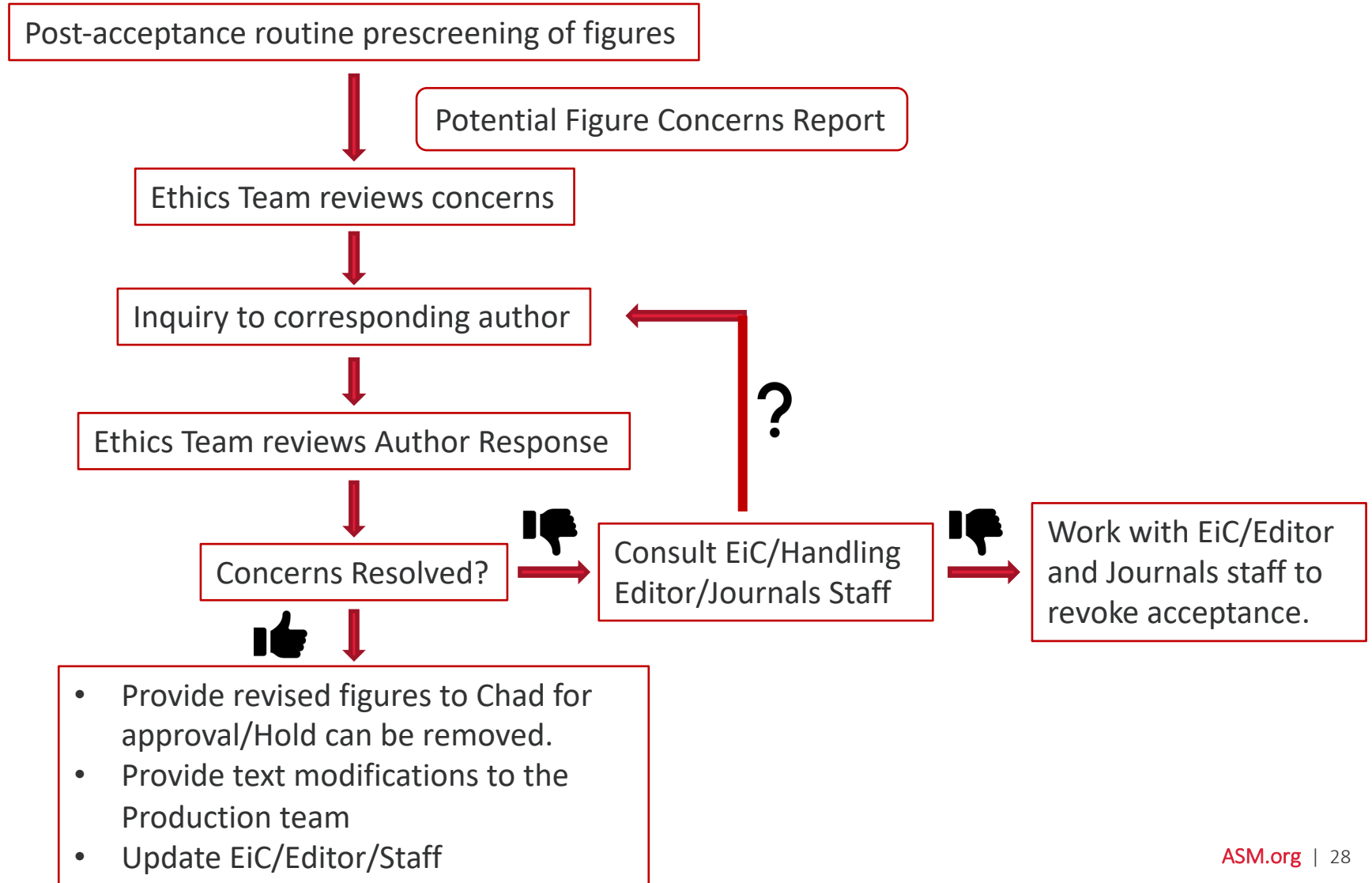


Concerns #1 with accepted manuscript:  
Figure had 2 sets of duplicates



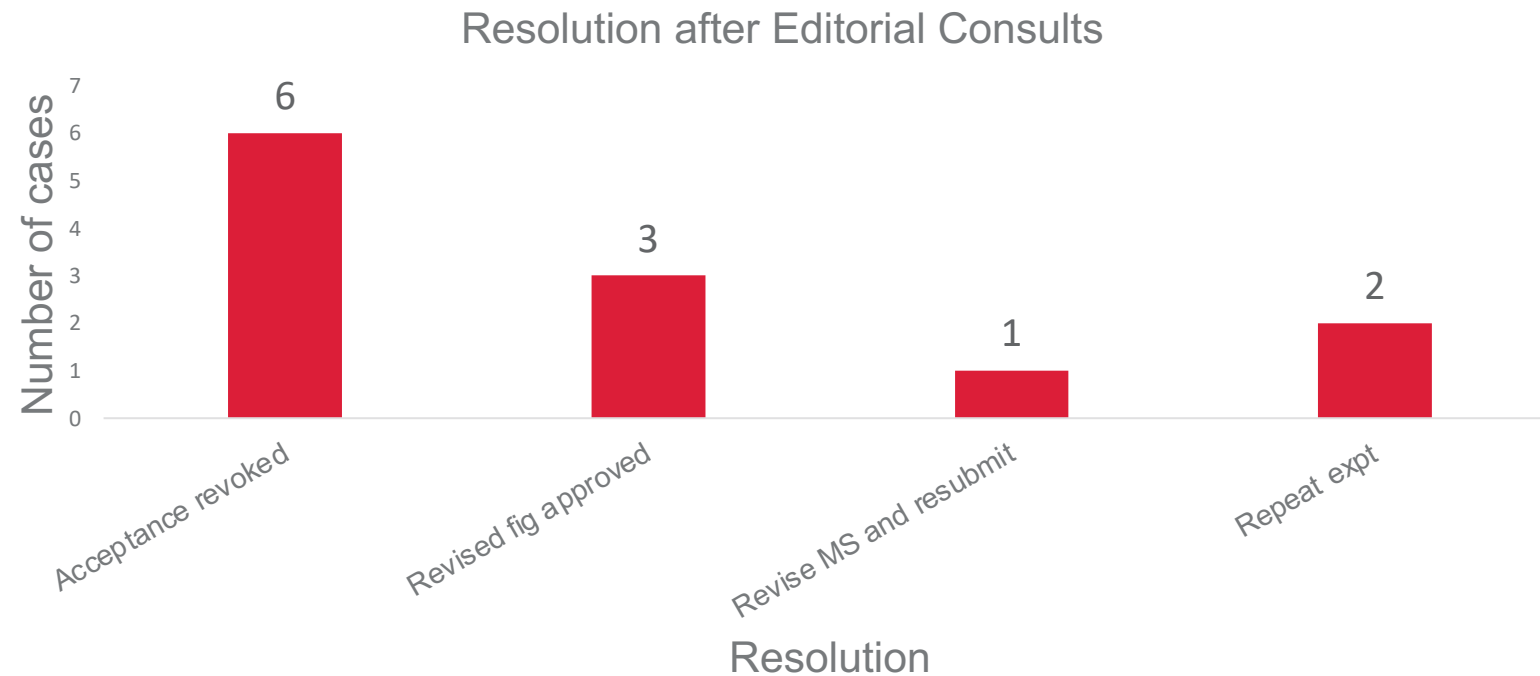
Concerns #2 after authors provided revised figure:  
A new set of duplicate images in data from replicate expt.

# Process to address figure concerns



# Acceptance was revoked in ~50% cases post editorial consult

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- Editorial consults requested in ~9% of all the image duplication cases.

Lessons learned- Part IV:  
Educating authors and  
publishers is crucial to  
publishing sound  
science.

# Educating Authors to prevent 'sloppy' science

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- **Retain original data**
- **Label all files** appropriately
  - Control blots can look surprisingly alike
  - Attribute in figure legend where necessary
- **Assemble figures cautiously**
  - Avoid “Copy and Pasting” errors
  - Verify each panel before every submission/stage of publication
- **Provide acknowledgements and permissions** for reusing previously published data, even if it is your own
- Experiments should be conducted several times to **verify reproducibility**
  - Avoid over-selling one-off experiments



# Publishers need appropriate checks and balances in place

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- **ImageTwin pilot program was an overwhelming success.**
  - ImageTwin identified 130+cases of image duplication during the pilot period.
  - Approx. 4% of all accepted manuscripts had potential duplication events.
- **ASM is addressing these concerns upfront prior to publication rather than having to correct the scientific record later.**
  - Further editorial assessment was requested in ~9% cases.
  - After editorial consults, acceptance was revoked in approximately 5% of all manuscripts with image duplication concerns.



# Lessons Learned- Part V: Where do we go from here?



# Next steps for ASM as a Publisher

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- Perform ImageTwin analysis at revision stage and not post-acceptance.
- Increase efforts to educate authors:
  - On various image duplication issues and how to address them.
  - Regarding better data and figure management.
- Develop guidelines for reviewers and editors to address these issues more effectively during the peer review process.
- Better clarity in process regarding editorial consults, replicate data considerations, next steps, timelines to provide 'new' data etc.
- Continue to learn, grow and stay committed to publishing sound science.



**Thank You!**

Questions? Contact Us.

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- **Email Aashi Chaturvedi**  
achaturvedi@asmusa.org
- **Email ASM Journals Ethics Team**  
ethics.journals@asmusa.org
- **American Society for Microbiology**  
1752 N Street, N.W.  
Washington, D.C. 20036

