

DRAFT (rev)

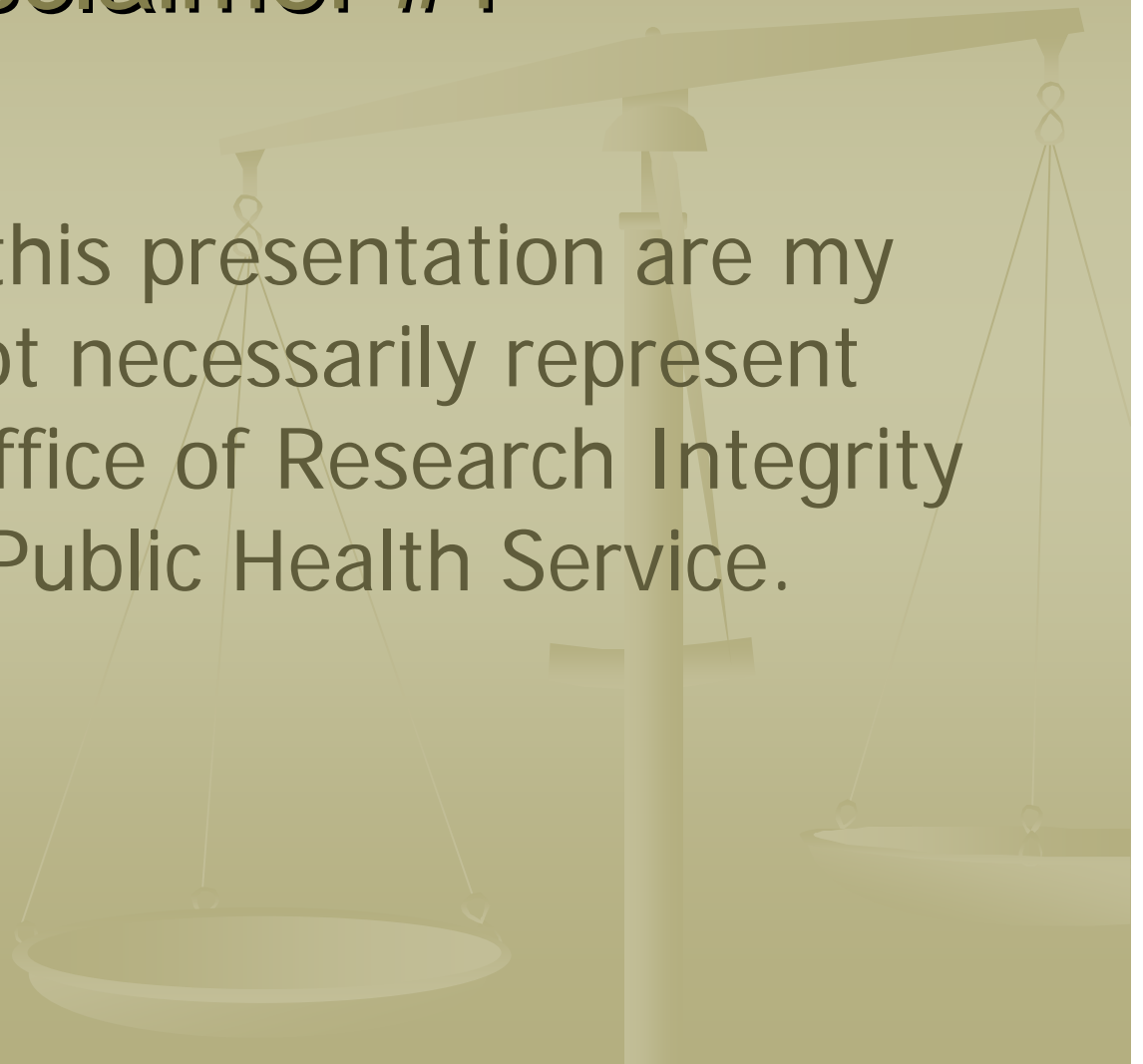
Image Manipulation in Science - *Detection and Choices*

John W. Krueger, Ph.D
“Emerging Trends in Scholarly Publishing”
Allen Press Seminar

National Press Club, Washington, DC
April 17, 2008

Disclaimer #1

The opinions in this presentation are my own and do not necessarily represent those of the Office of Research Integrity or of the U.S. Public Health Service.



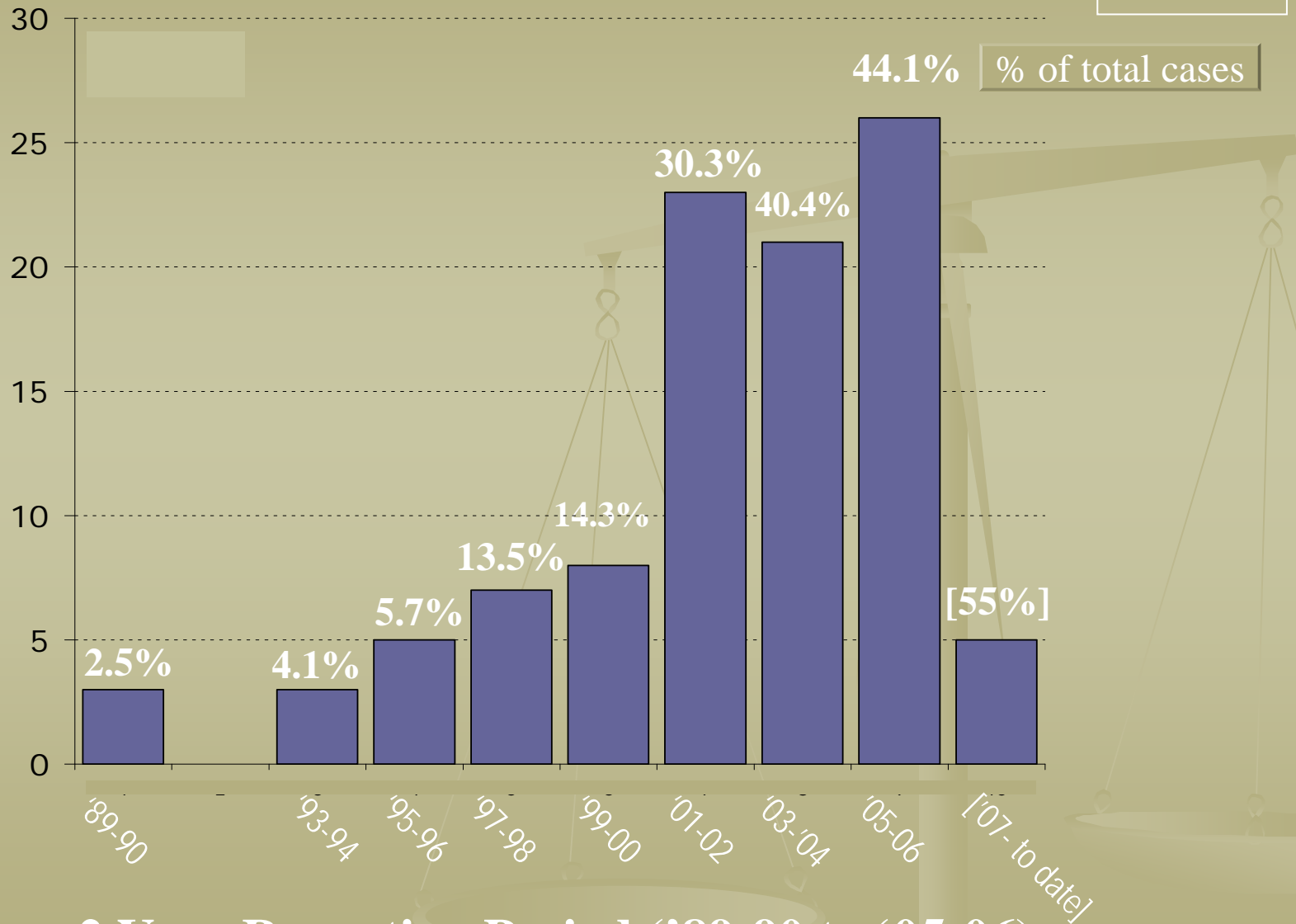
Manipulated Images & ORI:

"Research misconduct" means "fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results." Research misconduct does not include honest error or differences of opinion. Public Health Service (PHS) regulations at 42 CFR Part 93

ORI Cases With Questioned Images

Draft: 4/07
N = 100

Number of Image Cases Opened



2 Year Reporting Period ('89-90 to '05-06)

Technology & Image Manipulation

Data Acquisition > Reduction > Presentation > Reporting

Korean Cloning Hero **Deconstructed Online**

Ronda Hauben 24.12.2005

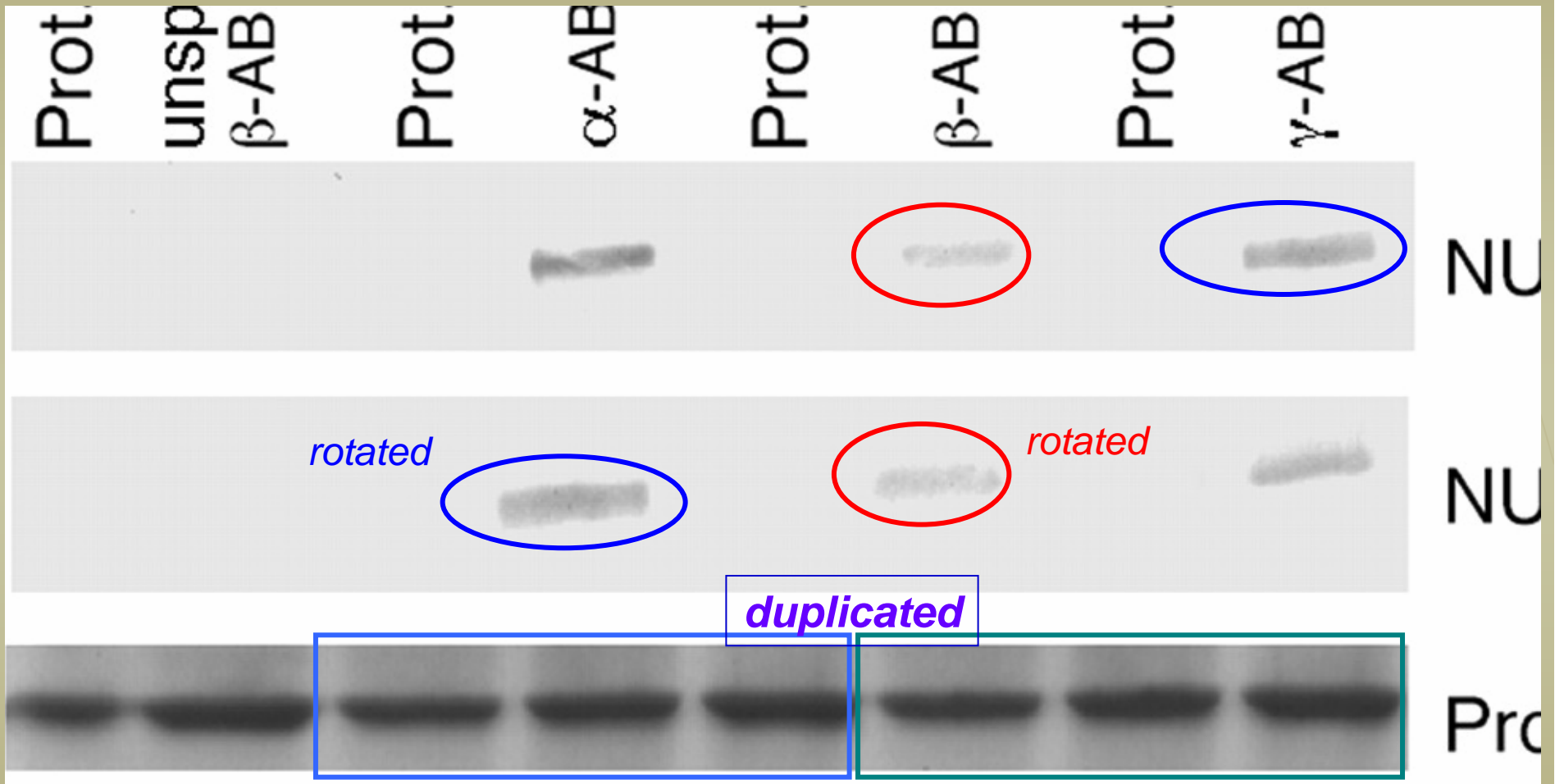
Online Scientific Community in South Korea

**Uncovers Fabrication of Data in Acclaimed
Stem Cell Research Papers**

<http://www.heise.de/tp/r4/artikel/21/21647/1.html>

Detection

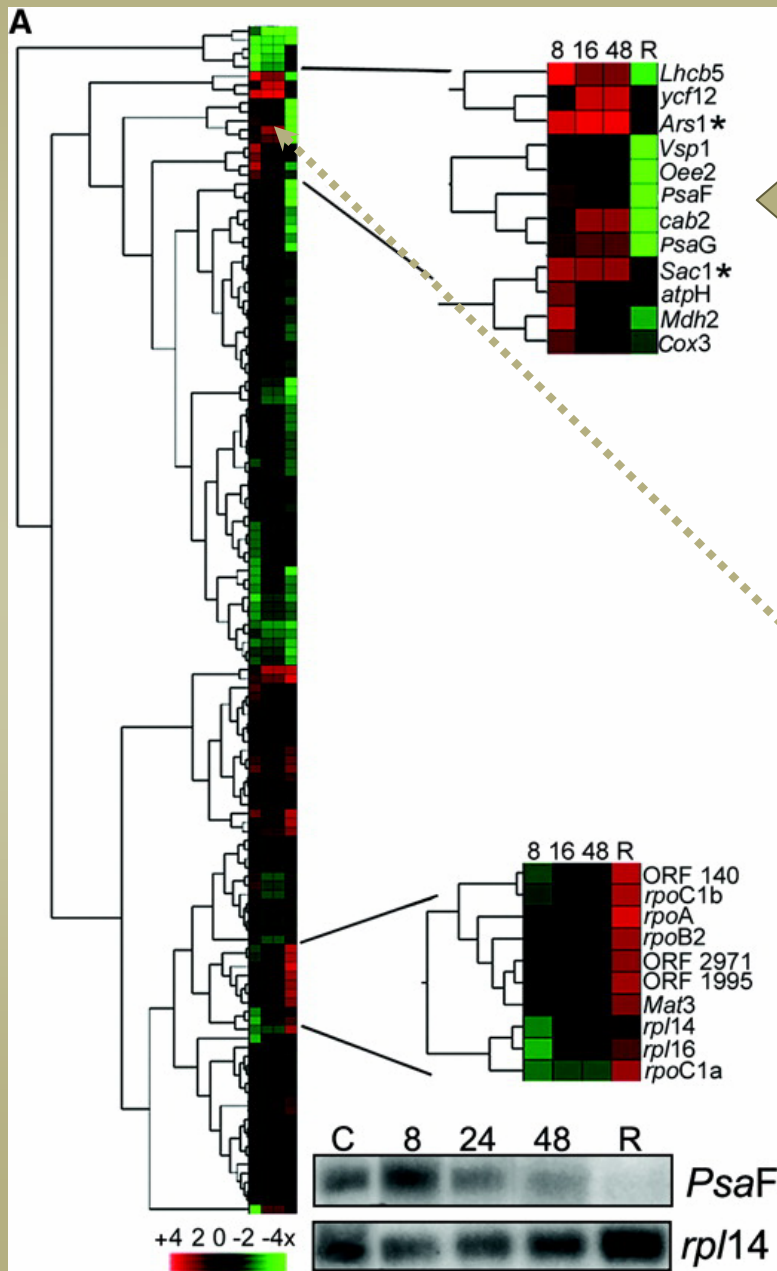
Scope 1: Bulk of Falsified Images are 'Blots'



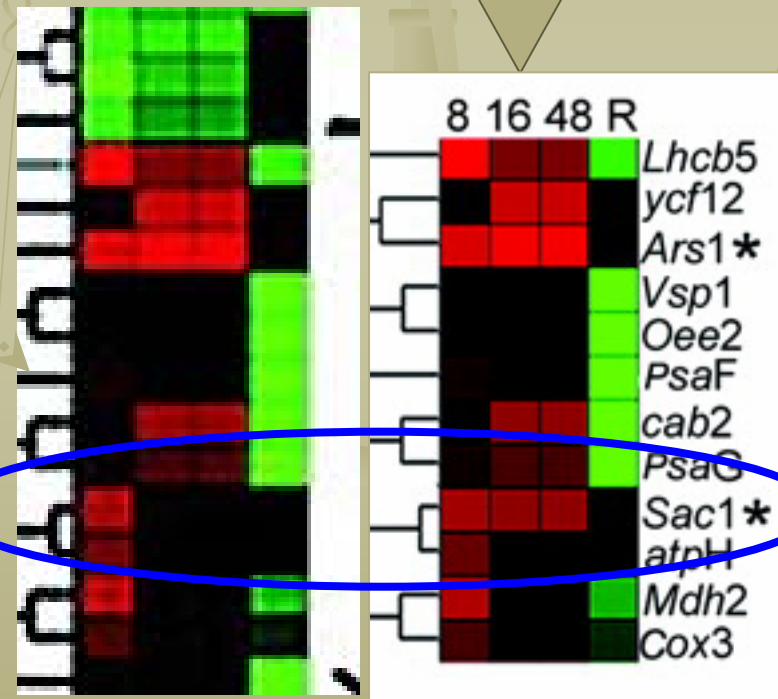
Portion of On-Line Journal Image

Note Multiple Inconsistencies

Scope 2: But It's Not Just Blots



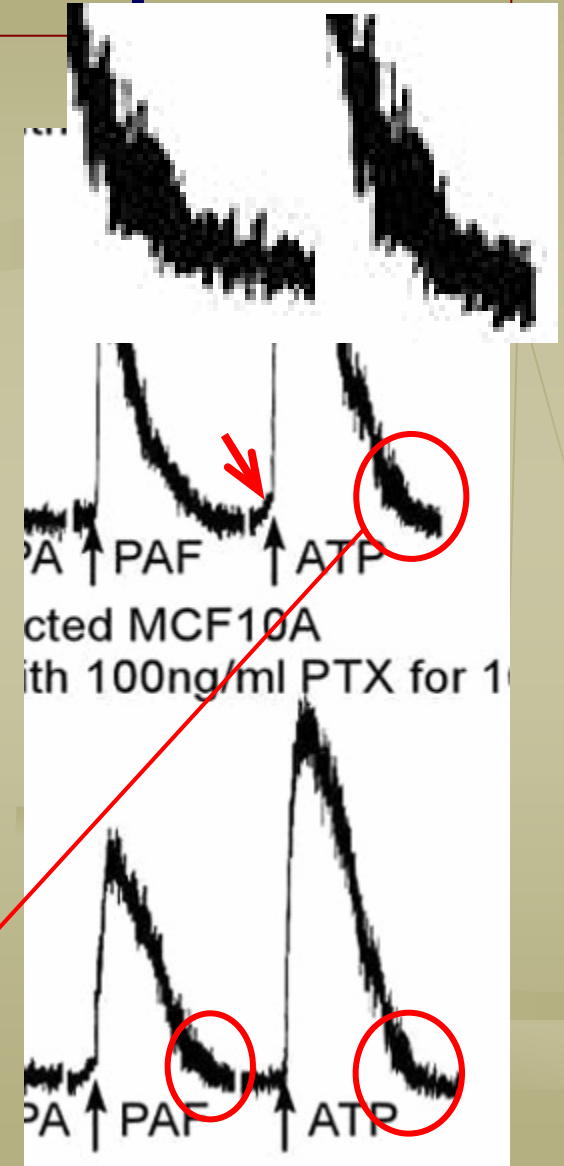
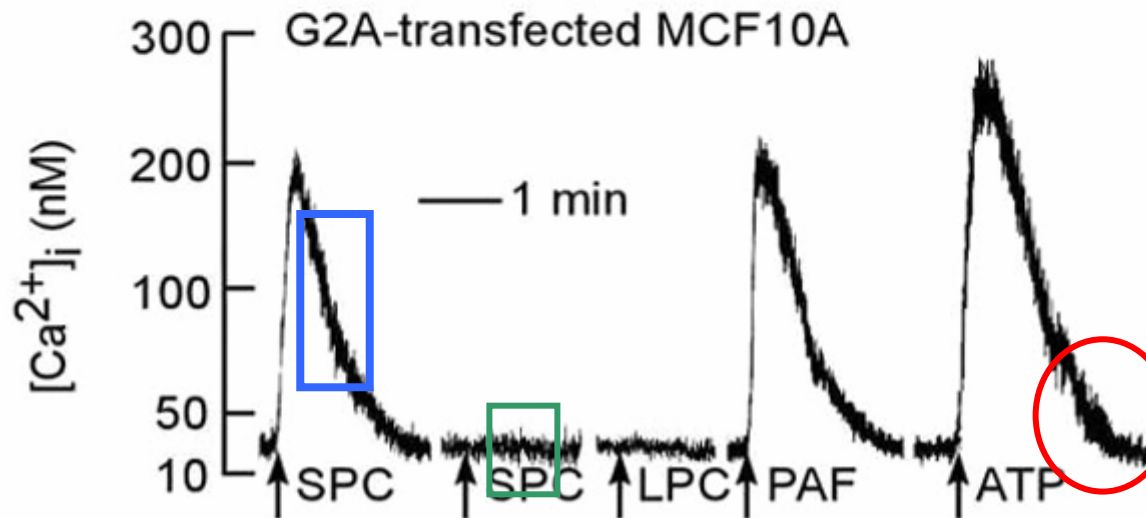
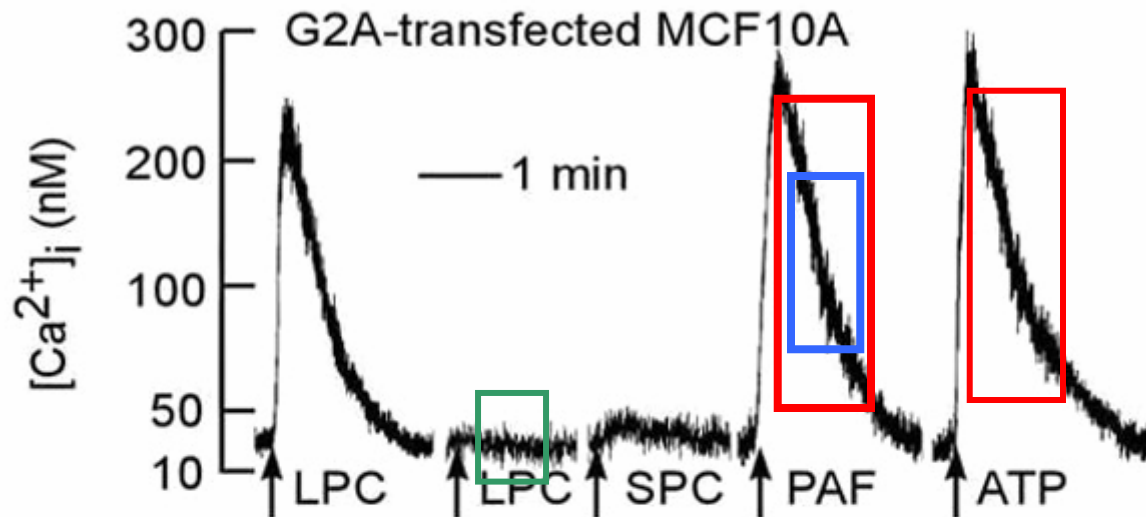
Author
"tells"
us where
to look



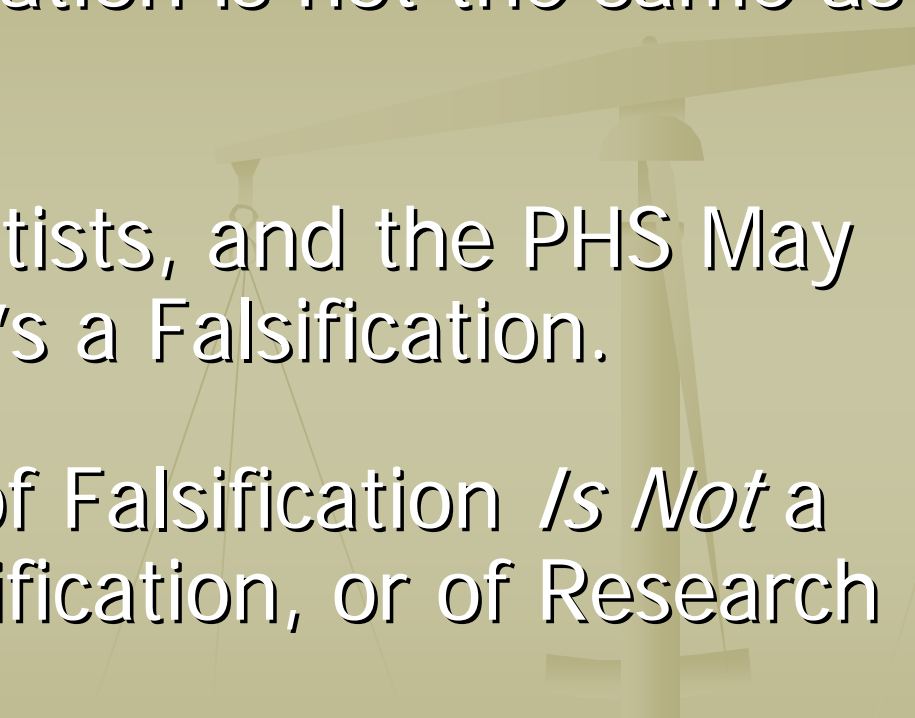
Note: * denotes key metabolic gene

Scope 3 . . . And it's not just pictures:

D



Disclaimers #2-4

- Image Manipulation is not the same as Falsification
 - Journals, Scientists, and the PHS May Differ on What's a Falsification.
 - An Allegation of Falsification *Is Not* a Finding of Falsification, or of Research Misconduct.
- 

Source Material–Internet

... Look for “Inconsistency”

- Photoshop (Adobe, \$\$)
- ImageJ [Cross Platform, Public domain]
<http://rsb.nih.inf.gov/ij>
- ORI Forensic Tools:
Droplets and Actions.

ORI Forensic Droplets



- Interface between a web browser and a pre-programmed Photoshop routine
- Educational tool for investigation committees, etc.
- Actions can be imported to customize and update Droplets to newer Photoshop (CS>)
- Prototype is at: **ORI FORENSIC TOOLS**

•(http://ori.hhs.gov/education/data_imaging.shtml)

Increase *Visibility* of “Hidden” Details

The human eye detects
only 40-50? shades of
gray

The human eye detects
only 40-50? shades of

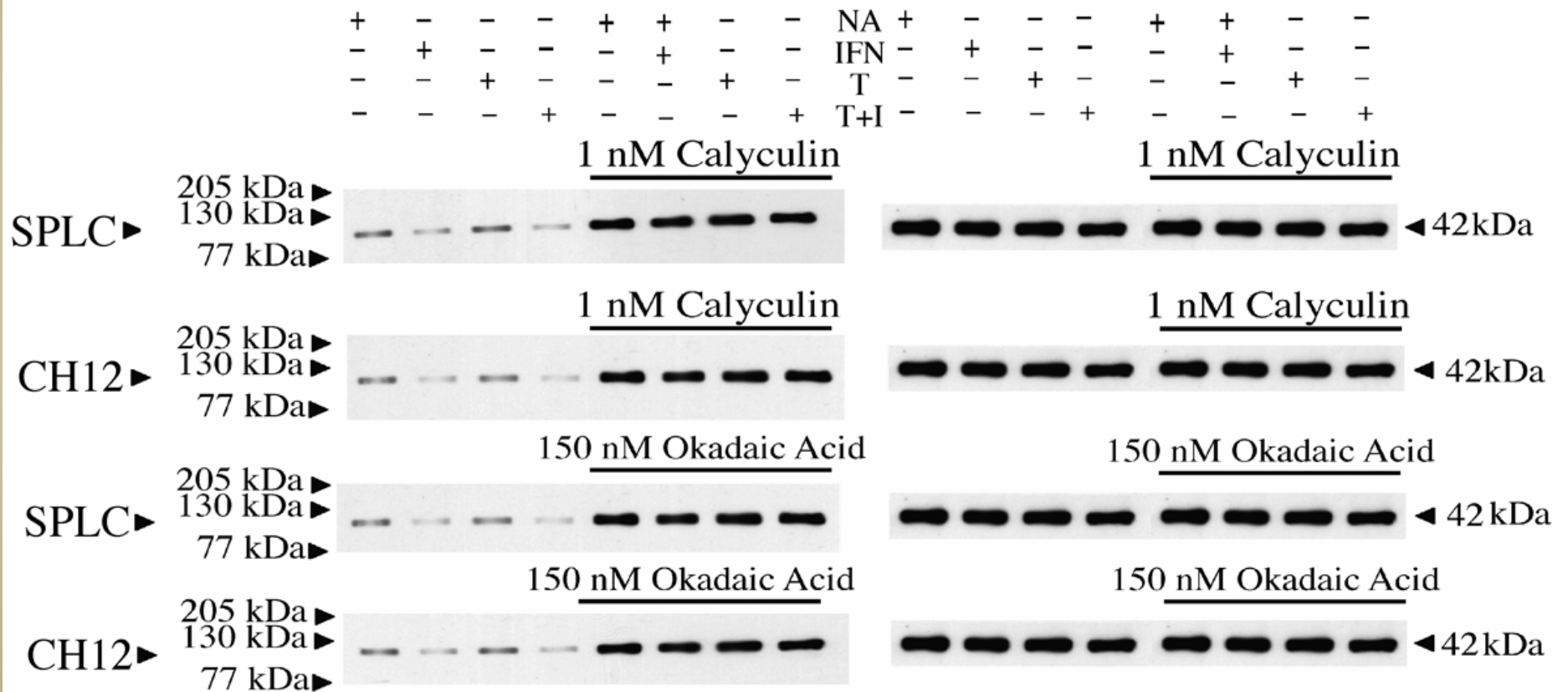
The human eye detects
only 40-50? shades of

The human eye detects
only 40-50? shades of
gray

But COMPUTERS
Love Small Changes
in Gray and Contrast



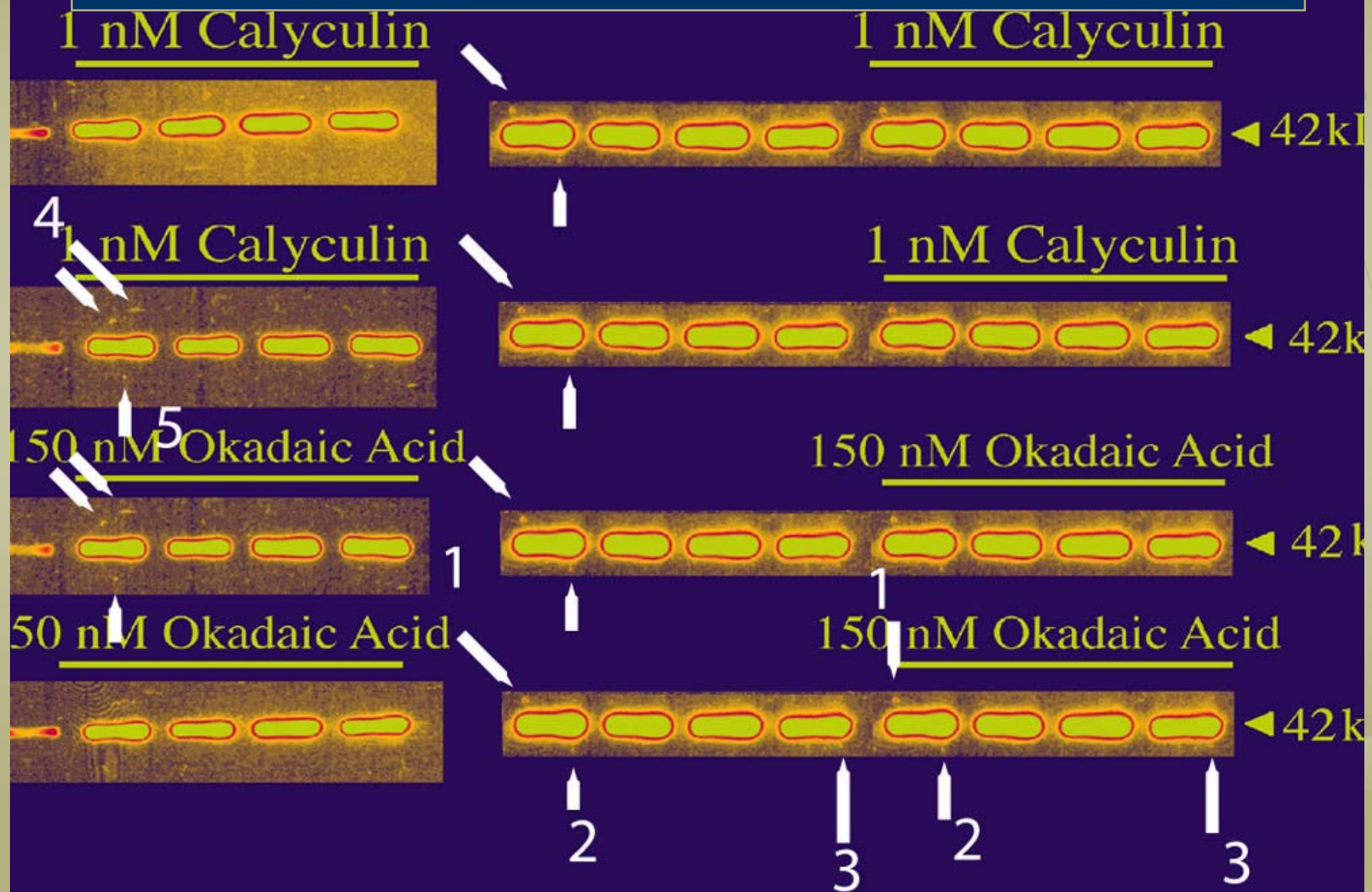
1. Background



Detection

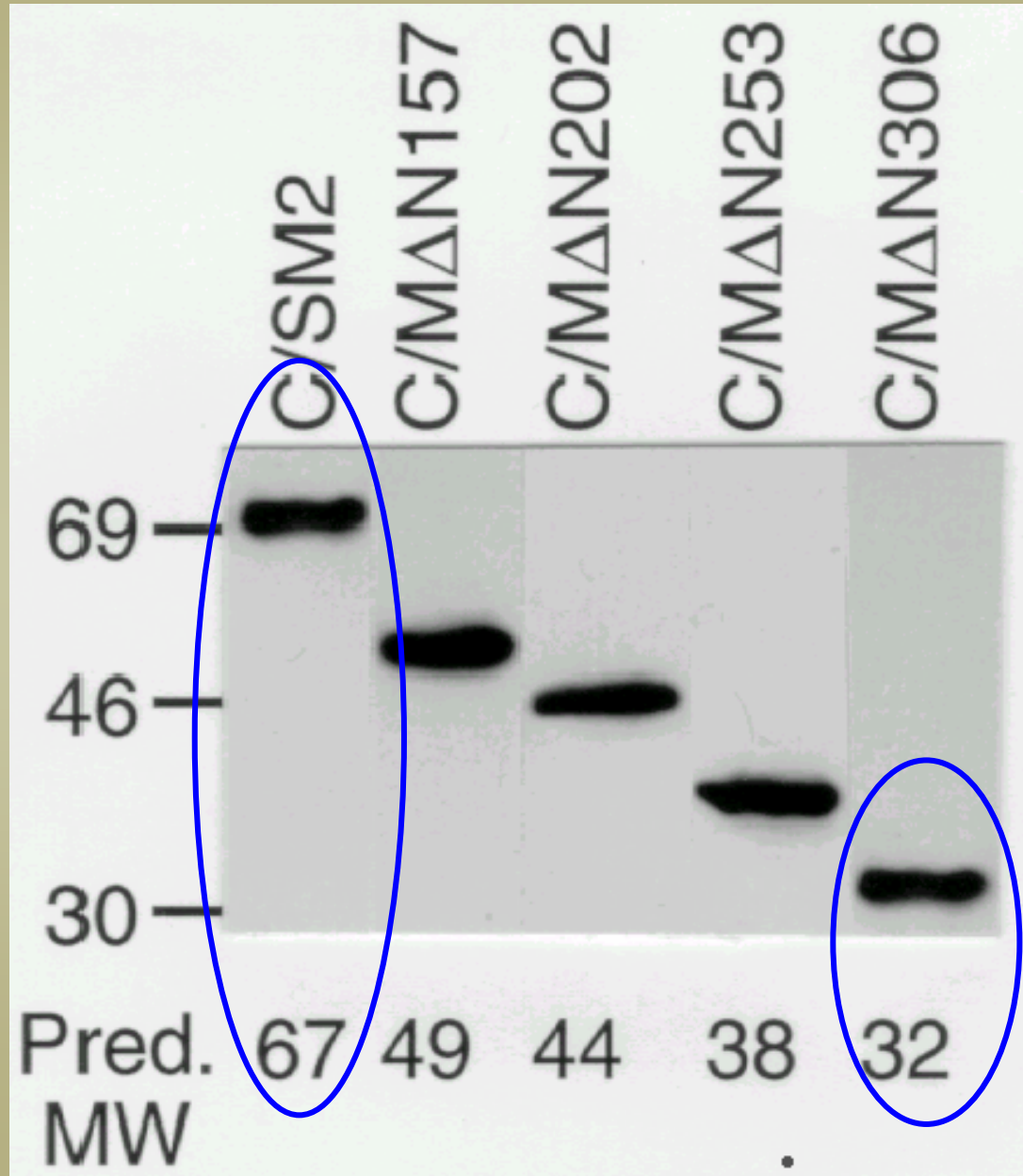
+	+	-	-	NA	+	-	-	-	+	+	-	-	
-	-	+	-	-	IEN	-	+	-	-	-	+	-	-

Background: "Gradient Map"



2. MORPHOLOGICAL FEATURES

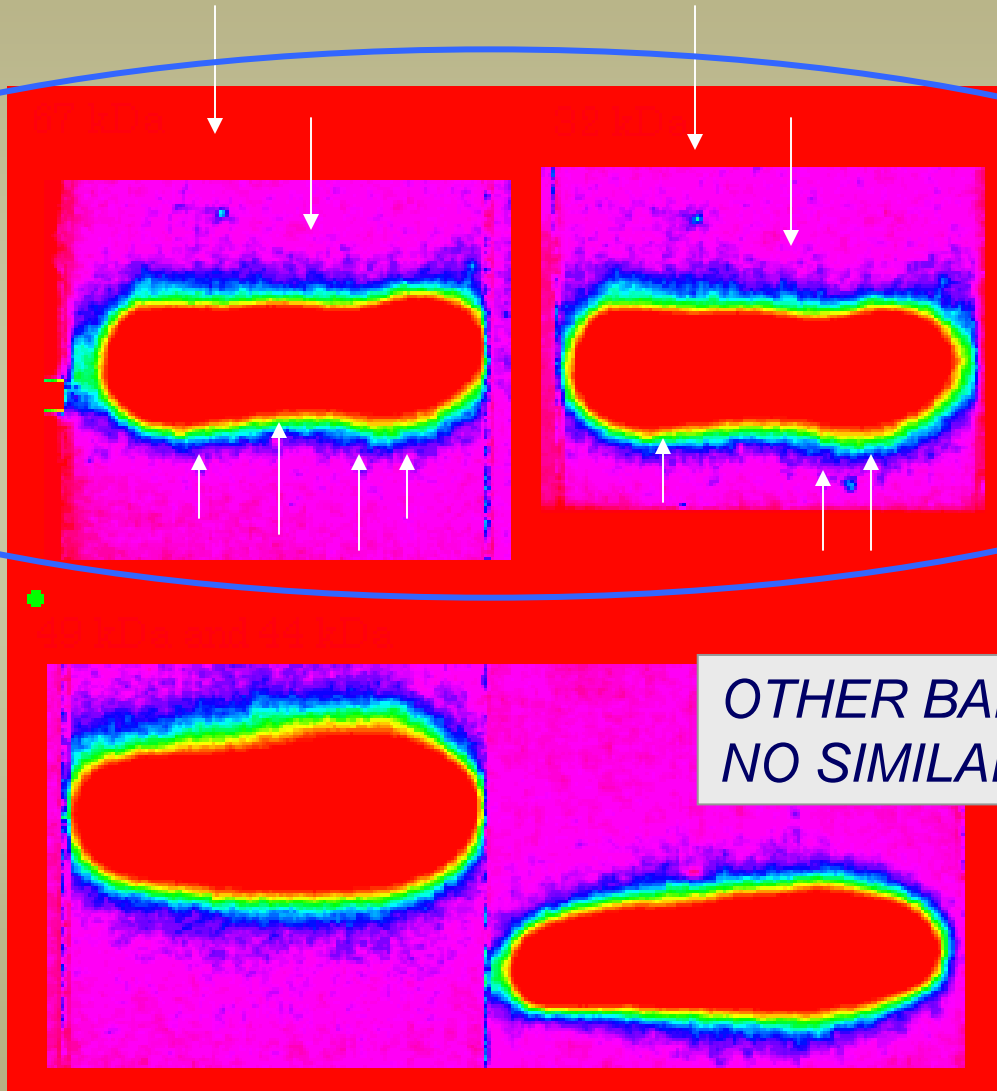
When No
Background



Detection

False Colorization reveals similar mini-features:

67 MW
band



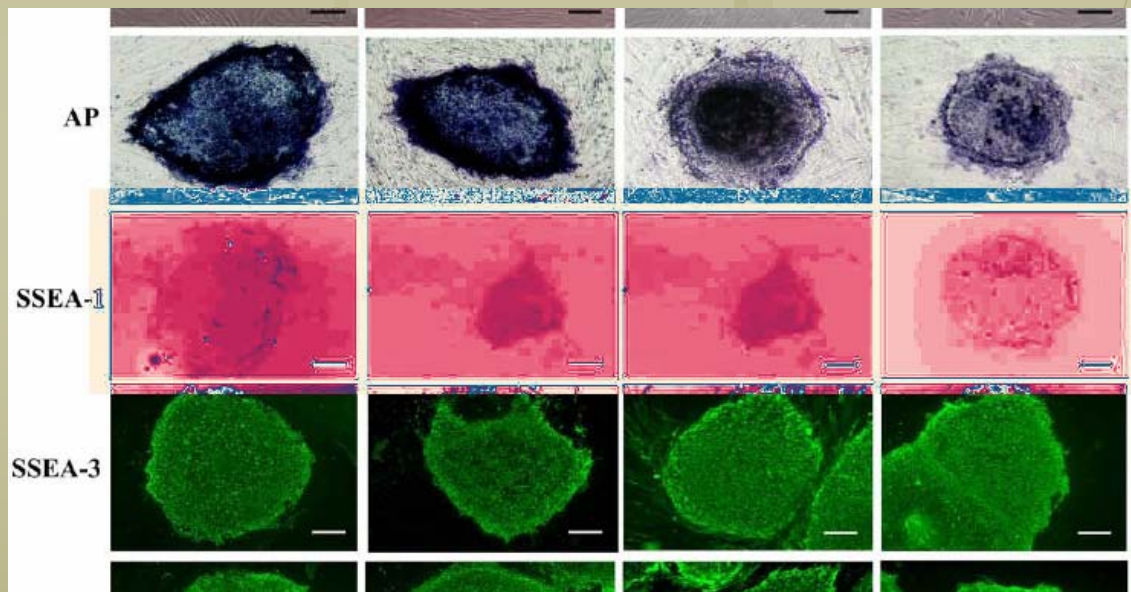
32 MW
band

OTHER BANDS SHOW
NO SIMILARITY

3. DETECT WHAT'S "NOT THERE"

Localized application
of Gradient Map

(Histogram Equal.
also works . . .
but restrict area!)



Science 308 (5729): 1709-1805, 2005, Suppl. Fig S1b

Other Means For Detection

- **“Photo-Shopping”:**
VISUALIZE INCONSISTENCIES . . . Relies on perception & maybe bench experience
- **Mathematical Detection:**
STATISTICAL INCONSISTENCY BETWEEN THE IMAGE ELEMENTS . . . Automatic:
Finds resampling, outlawed colors, smoothing, texture, duplications, *etc.*

Any Method: Interpretation

RESULTS: “Mapping” is Determinative

Pattern reveals motive?

ISSUES: Sensitivity and Robustness

False positives/false negatives

Limited by image compression

PURPOSE: Screening vs Investigation

AUTHENTICATION: Need Original Data!

Choices

20-28%: “Presentation Issues”*

1%: Evidence for Falsification*

***The “1%-ers” Require that Institution:
ASSESS,
conduct an INQUIRY
and/or maybe, an INVESTIGATION***

*Public Statements about images in accepted MSS,
as detected in Preflight Screening by *Blood, JBC.*

Send Serious Allegation to the Correct Institutional Official!

What will happen if you send it to:

What Happens to

• The Corresponding Author?
“Missing Allegations”?

. . . or . . .

• The Departmental Chair?
Who has Published?

• The Research Integrity Officer, RIO?

Manuscript “Review” Now:

- Extends To All
- Includes the Public
- *and Lasts Indefinitely!*


- *Challenge: Is Retraction Warranted when the Data is Missing?*

([we] biologists have finally realized a secret yearning to be like physicists)

Timely Issues:

- Interpretation: Presentation Issue *vs* Falsification?
- Shared Interest in Data Retention.
- *Downside* to Prescreening: Over Interpretation, Inappropriate Disposition.
- Enforce Standards for Submitted Images?
- Is Supplemental Material Reviewed?
- Shifting Accountability for the Scientific Record.

ORI Assistance to Editors

- **Can Provide Technical Advice**
(Google “Forensic Droplets”/Actions) 
- **Occasionally Provides Technical Assessment in non-PHS cases (Public)** (as a “peer reviewer”)
- **Identify Institutional Official (RIO)** for Journal’s referral of its allegation

Contact Information:

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*Also for image advice :

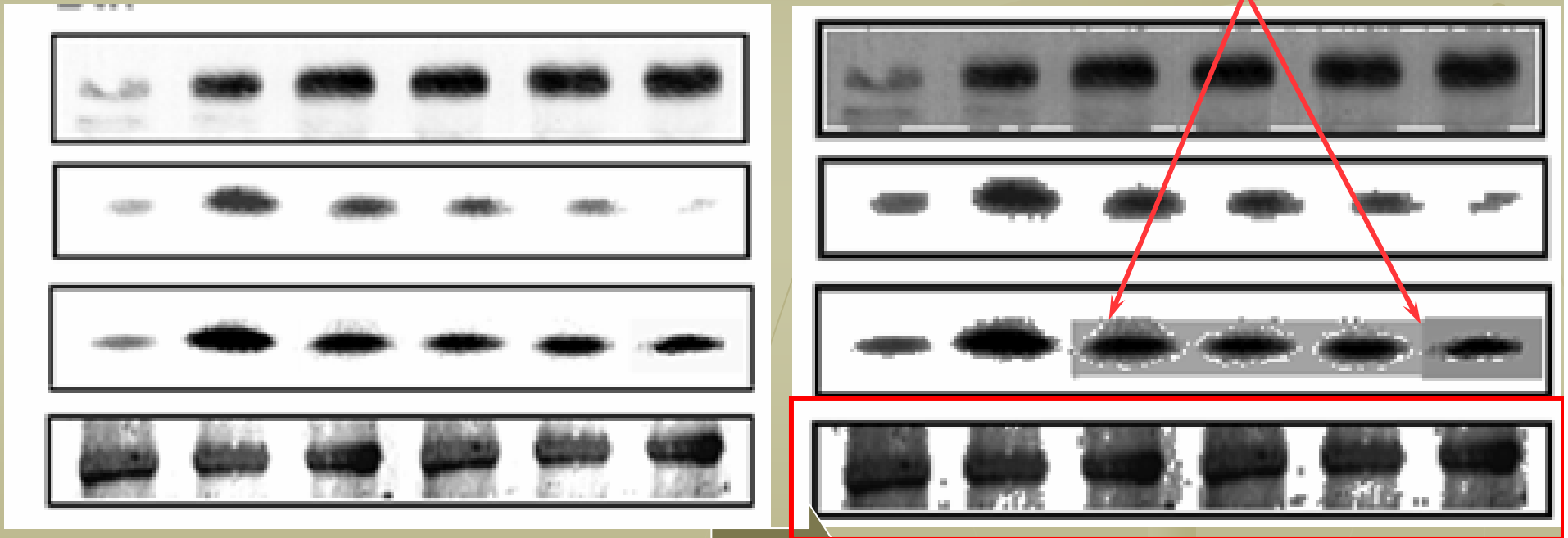
Sue Garfinkel, John Dahlberg



Choices

(~20-28%): Presentation Issue?

**“COMPOSITING” or
“SPLICED” DATA**

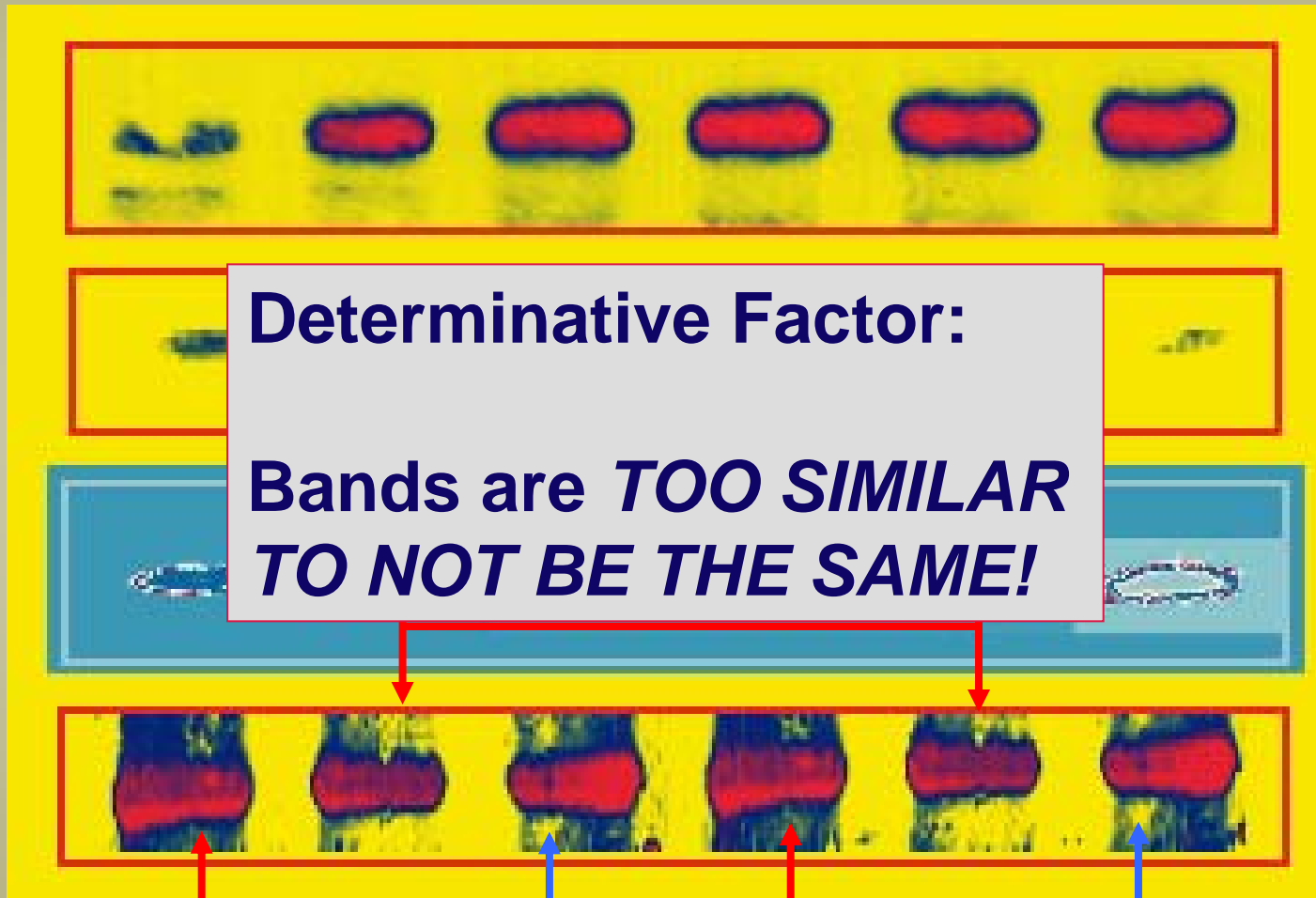


Next slide

Effect of Histogram Equalization:

(shown with permission)

(1%): Allegation of Falsification



Catching Manipulation

