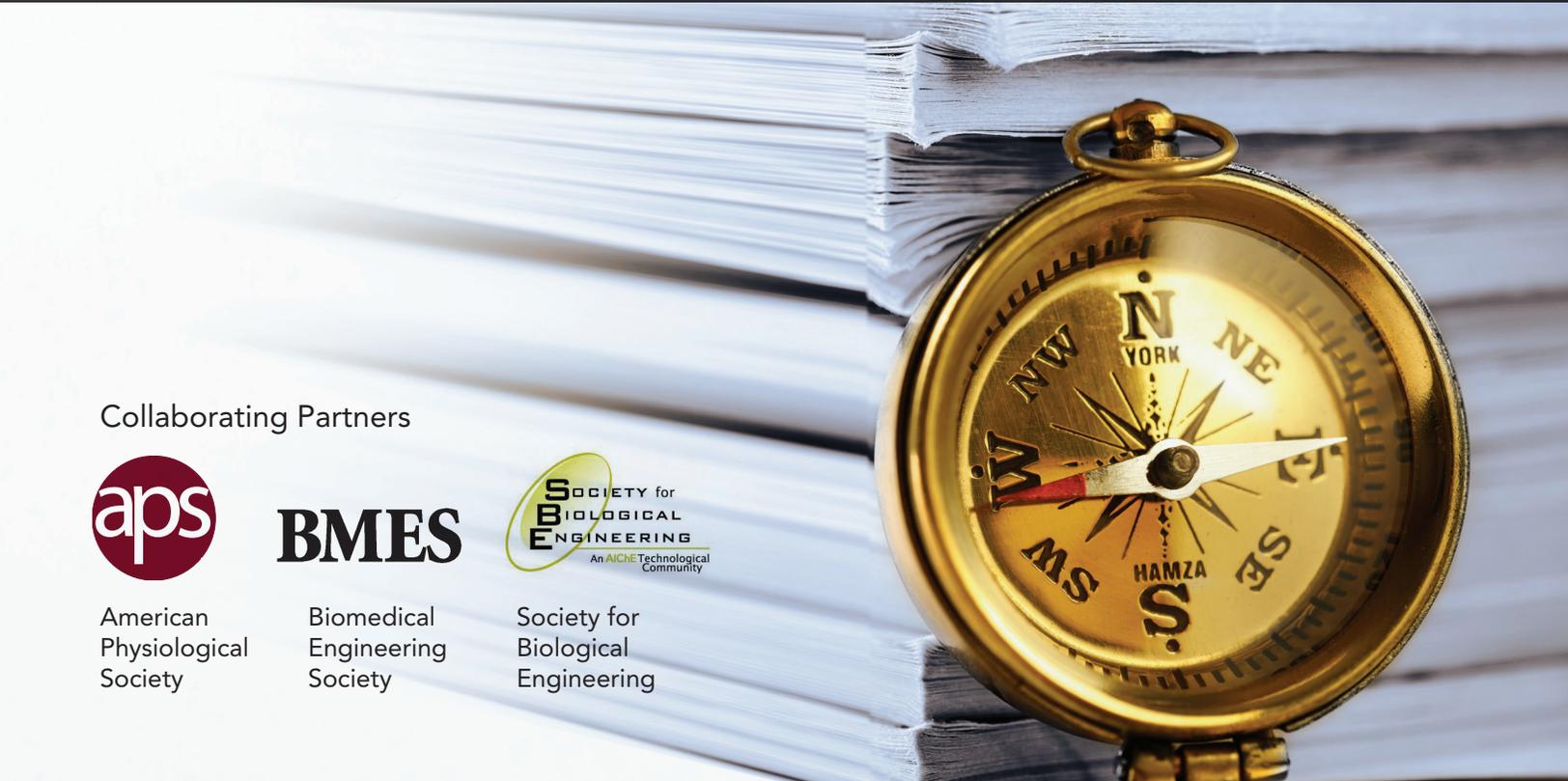




PROFESSIONAL INTEGRITY: BEST PRACTICES FOR PUBLISHING YOUR RESEARCH

# Data Fabrication and Falsification

Christina N. Bennett, PhD and Marsha Lakes Matyas, PhD



Collaborating Partners



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# **Data Fabrication and Falsification**

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# I. Pedagogy

This module is designed to promote best practices in publication ethics for life scientists and biomedical engineers who publish research papers. The goal is for students to not only understand professional standards of practice in research manuscript development but also to be able to apply these standards to their own work AND to be prepared to teach them to their own students in the future. Toward that end, this module employs student-centered learning strategies that engage students across the spectrum of Bloom's taxonomy (see below). For best impact, students should not simply sit and listen or read and answer questions. Instead, we encourage you to use multiple teaching methods and activities that engage students in actively exploring the topic. Some suggestions you will find in this module include:

- **Interactive Lecture:** The lecture slides and notes include a number of places to stop and engage students in working out a problem, discussing a policy, or reviewing a case study.
- **Think/Pair/Share:** Often part of an Interactive Lecture, students are given a problem to address first on their own, and then they are asked to share their responses with a partner, followed by sharing with the whole class.
- **Voting Cards:** Particularly when discussing ethics issues, students prefer not to raise their hands to indicate their answer to a group question. Consider using voting cards with a simple large-print "Yes" on one side and "No" on the other. Everyone raises their hands and votes and you can quickly visualize the class response. An alternative is "thumbs up/thumbs down" but this is harder to see.
- **My Best Practice Checklists:** These are working documents each student develops to use now and in the future as their personal checklists of best practice in publication ethics.
- **PASS IT ON:** As part of their My Best Practice Checklists, students should make a plan for teaching publication ethics to their future trainees.

Instructors can pick and choose which activities and resources they want to use from the module. However, we encourage you to consider using the Learning Cycle approach because of its rich opportunities for student-centered learning. Alternatively, the Homework/Interactive Lecture/Activities (HILA) approach can be used when class time is limited. Both approaches are outlined below.

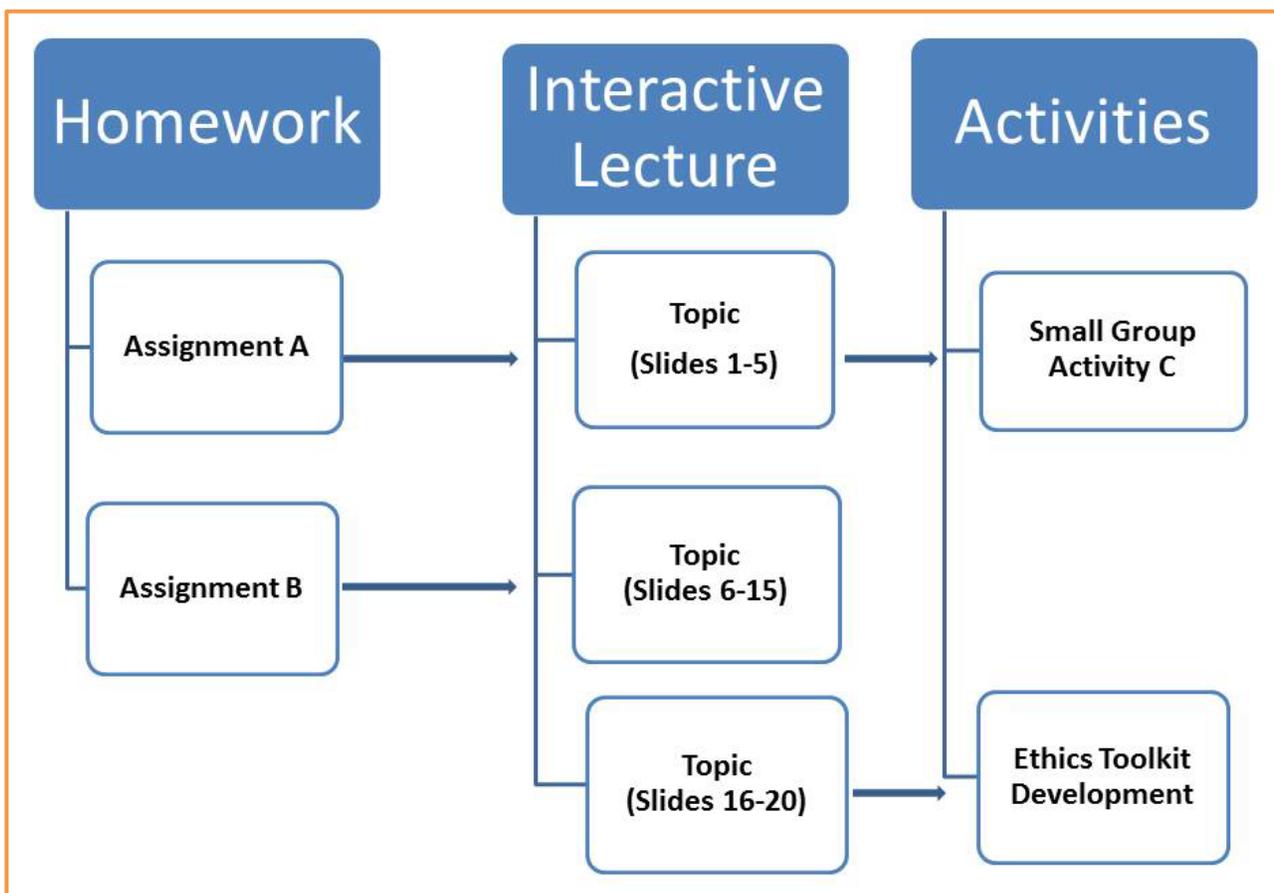
## Learning Cycle

- **Engage:** Piques students' interest in the topic and poses questions or issues that capture their thinking. *Examples:* News articles on ethics violations and examples of manipulated figures.
- **Explore:** Students explore and ask questions, investigate via inquiry, make observations, and test hypotheses. Students should generate additional questions by the end of the exploration phase. *Examples:* Case study that students must try to resolve individually or in groups without additional information on professional standards of practice (these would be readdressed in the elaborate phase below), compare CV's of researchers, interpret letters from editors including comments/questions from reviewers, or write a letter to the editor describing figure manipulation in a manuscript to be submitted.

- **Explain:** Students and instructors use questioning/discussion, reference materials (print and online), expert presentations, and other resources to gain a better understanding of the key principles of the lesson and how they apply to the questions raised by students in the explore phase.
- **Elaborate:** Students apply what they have learned to real scenarios. *Examples:* Students revise their response to the explore phase case study using the principles and knowledge gained in the explain phase, and then do the same for a new case study or, ideally, their own work. Create a personal action plan or checklist for professional standards to use in the future.
- **Evaluate:** Evaluation occurs through each phase, with evidence collected of both student understanding of key principles and information and their ability to apply it to new situations and problems. *Examples:* Changes in approach to case study before and after the explain phase. Personal action plan/checklist addresses the key principles of professional practice. Key principles are applied appropriately to new case studies. Can also include quizzes or tests of content knowledge of professional standards of practice.

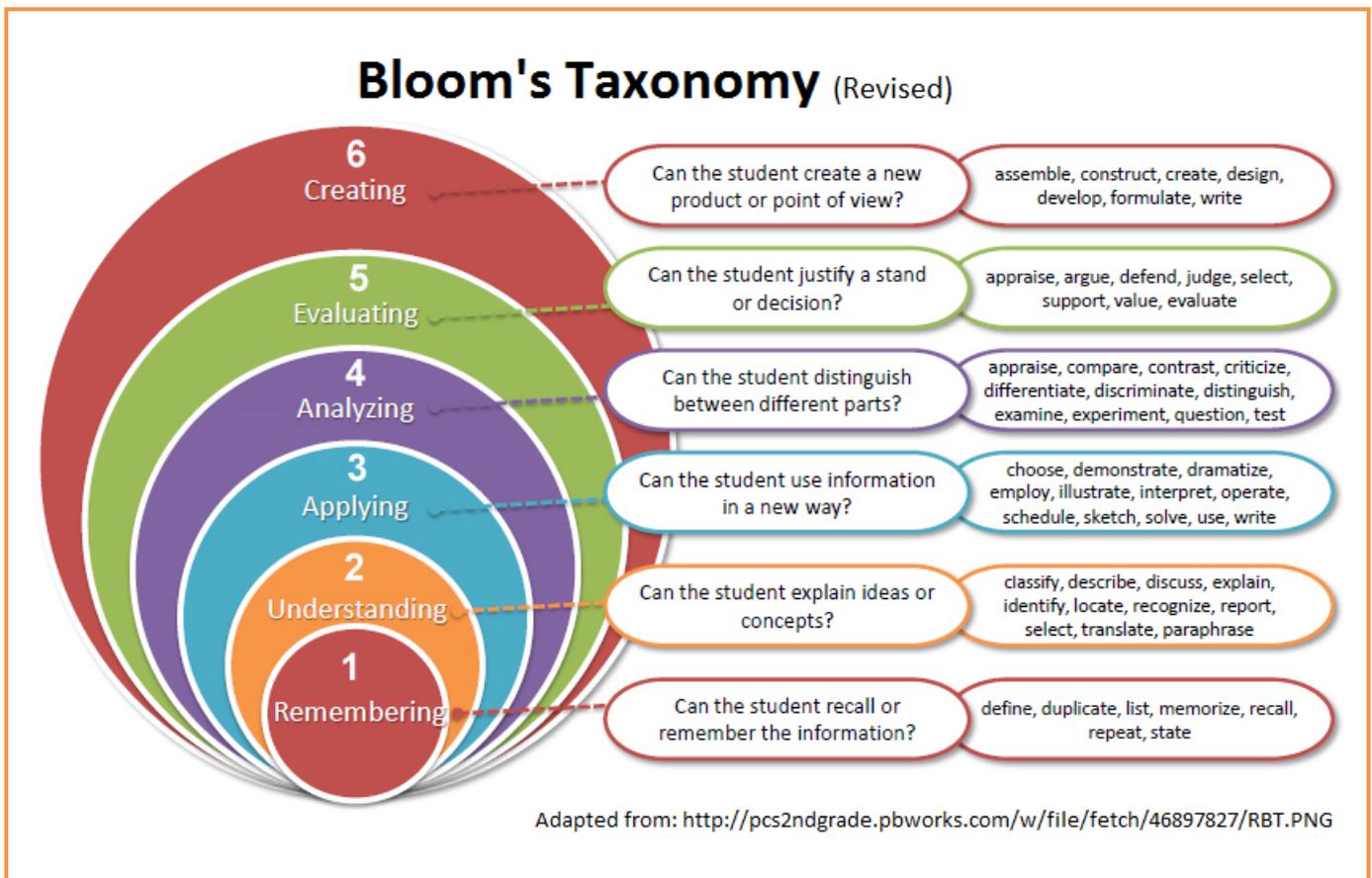
## Homework/Interactive Lecture/Activities (HILA)

Homework activities are discussed either during the Interactive Lecture or during follow up activities.



## Bloom's Taxonomy

Bloom's Taxonomy (established 1956, revised 2001) helps educators more effectively structure their teaching, student learning, and assessment of skills and knowledge. Organizing learning objectives by Blooms Taxonomy helps educators assure that lessons do not focus solely on memorizing basic knowledge but also challenge students to apply what they learn, evaluate new situations, and create solutions to challenging problems. Higher level objectives engage students in learning situations that are more complex and abstract. Overall, the professional ethics lessons in this series of seven modules focus strongly on the higher Bloom's levels (5 – Evaluating (20%) and 6 – Creating (21%)) in addition to including objectives for basic knowledge (Level 2 – Understanding (30%)) and application (Level 3 – Applying (14%)).



## Student Handouts

The student section of this guide is formatted for easy duplication. This guide is also available as an MS Word (.doc) file (See References). We encourage you to provide both printed and .doc formats to students. The lessons are designed to help students create a personalized guide for their future work; developing their notes and best practices plans in a .doc format will help students use as well as modify their plans in the future.

## II. Module Objectives

<b>Students will be able to:</b>	<b>Bloom's Levels</b>
1. Define data falsification and fabrication (DFF) and identify examples of each	1, 2
2. Justify why the self-correcting nature of science does not eliminate the scientific community's concerns about data falsification and fabrication	6
3. Identify the stakeholders in DFF and describe the potential outcomes of DFF for each stakeholder	4, 6
4. Explain how applying acceptable standards of practice for maintaining original records and primary data reduce the chances of DFF.	6
5. When dealing with a research misconduct concern, identify the relevant personnel at your institution and determine the optimal order in which to approach them.	1, 3
6. Summarize the outcomes that may result from an investigation of publication misconduct related to DFF.	2
7. Develop or update your best practices checklist for data management and storage to reduce the chances of DFF.	6

## III. Instructor Guide

### Target Audience

This module can be used with both graduate students and undergraduate students. It was initially designed for early career graduate students in biological science, medical science, or biological engineering graduate programs. Graduate students are likely to be somewhat aware of the academic publishing process but may not have had first-hand experience. Undergraduate students engaged in research and scientific writing may also find the materials useful.

### Instructor Tips

- 1) Select the objectives and related activities that you want to address. Edit the PowerPoint Presentation to include the activities and objectives selected.
- 2) The script/key points for the presentation are in the notes section of the PowerPoint slides.
- 3) We encourage you to share 1-2 minute personal stories, when appropriate. Keep the stories positive (i.e., “I had a dilemma and I utilized a best practice...dilemma resolved”).
- 4) Allow students to reach conclusions on their own. You are their guide through this class. Facilitate discussion to keep them on task and within time limits.
- 5) **Be sure to include the “My Checklist” activity in each unit. This is the major “take away” lesson through which students integrate what they have learned in order to develop: 1) their personal checklists for ethical writing; and 2) their plans for teaching publication ethics best practices to their future trainees.**

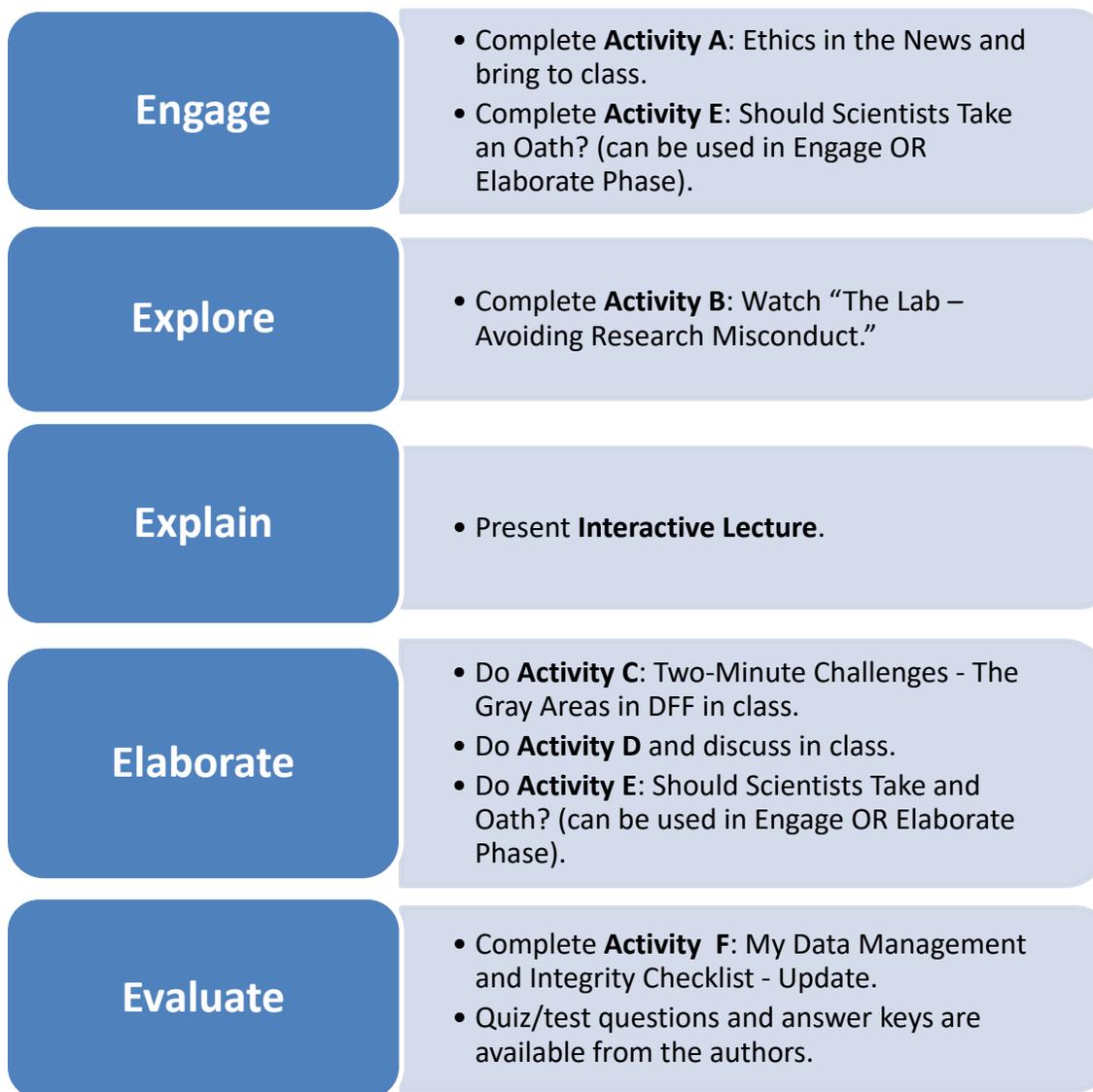
### Teaching Approaches

Learning Cycle and Homework/Interactive Lecture/Activities (HILA) approaches are outlined below.

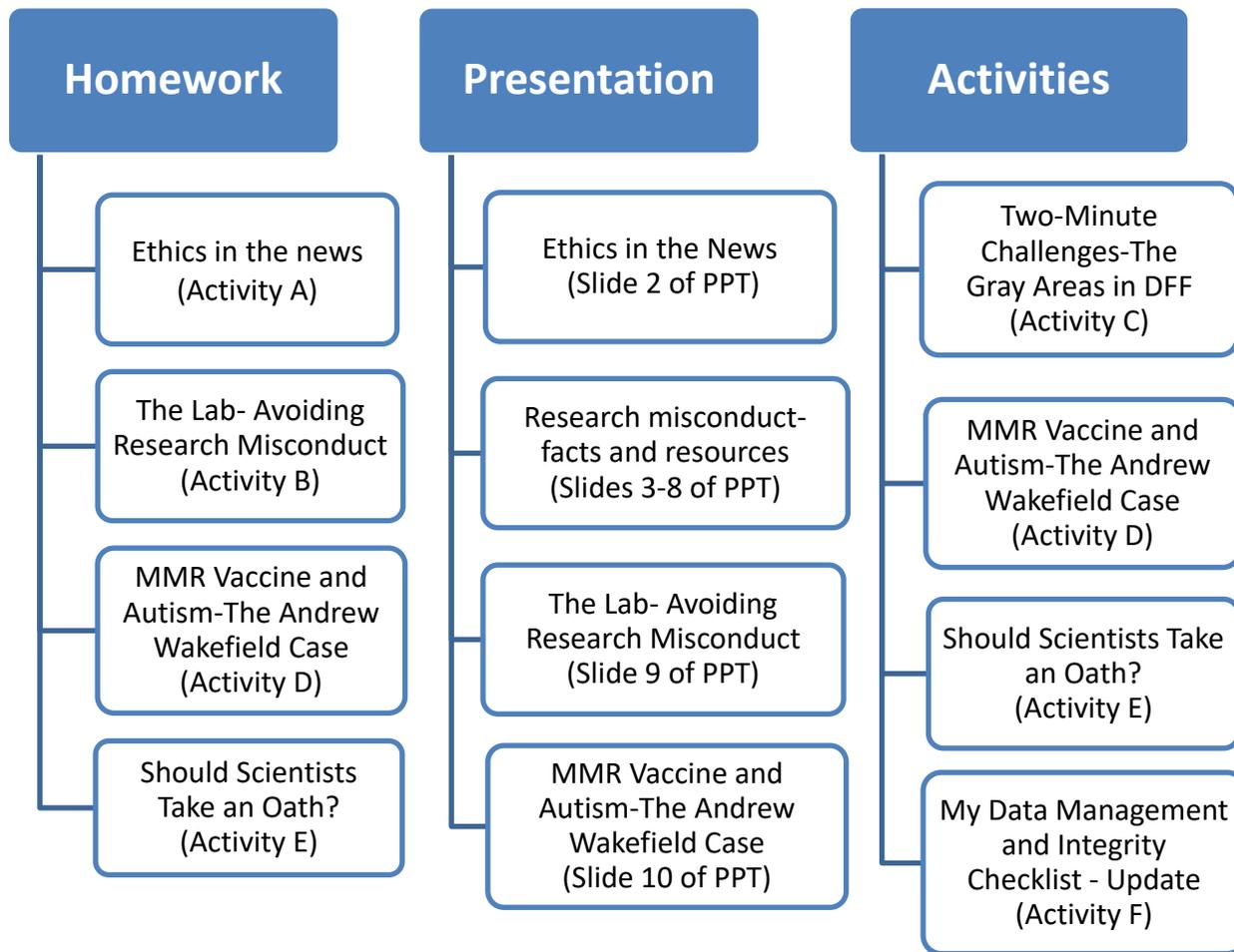
### Evaluation Rubrics and Test Questions

Evaluation rubrics for assignments and test questions are available on request from the authors (email: [education@the-aps.org](mailto:education@the-aps.org)).

## Data Fabrication and Falsification Learning Cycle



## Data Fabrication and Falsification Homework/Interactive Lecture/Activities



## Activity A

### Ethics in the News

**Purpose** This activity will increase students' awareness of research integrity issues in the public eye and the consequences of ethics violations. After completing this activity, students should be able to identify examples of data falsification and fabrication (DFF), identify the stakeholders in each research integrity case, and describe the consequences of the ethical violation.

**Objectives**

1. Define data falsification and fabrication (DFF) and identify examples of each.
3. Identify the stakeholders in DFF and describe the potential outcomes of DFF for each stakeholder.

**Procedure** **Learning Cycle:** Students complete the Activity A worksheet as an Engage activity.

**HILA:** Students complete the Activity A as homework. Instructor reviews responses with students during the Interactive Lecture.

Each student should find an example of a research integrity issue that was recently highlighted in the media and answer the questions on the worksheet. Instructor discusses their responses during the Interactive Lecture. Be sure to ask students to explain whether each example is a result of DFF.

Students will answer the following questions about their news article:

1. What concerns were identified?
2. What went wrong?
3. Who was found to be at fault?
4. Does the concern involve published articles or grants?
5. Is there a lab best practice that could have prevented this from happening?

**REMINDER:** Encourage students to note ideas they want to add to their *My Data Management and Integrity Checklist - Update*.

## Activity B

### “The Lab – Avoiding Research Misconduct”

**Purpose** This activity encourages students to consider the consequences of research misconduct AND how their own choices and communication strategies can lead to difficulties in professional ethics. After completing this activity, students should be able to recognize how research misconduct can affect both themselves and others, even if they are not the person guilty of misconduct. They also will understand how small decisions can contribute to larger ethical decisions.

- Objectives**
2. Justify why the self-correcting nature of science does not eliminate the scientific community’s concerns about data falsification and fabrication.
  3. Identify the stakeholders in DFF and describe the potential outcomes of DFF for each stakeholder.
  4. Explain how applying acceptable standards of practice for maintaining original records and primary data reduce the chances of DFF.
  5. When dealing with a research misconduct concern, identify the relevant personnel at your institution and determine the optimal order in which to approach them.
  6. Summarize the outcomes that may result from an investigation of publication misconduct related to DFF.

**Procedure** **Learning Cycle:** Use in the Explore phase, either individually or in small groups. Be sure that students try different roles so they can see how each choice affects the overall outcome.

**HILA:** Students do the learning simulation online as homework and discuss during the Interactive Lecture. Be sure that students try different roles so they can see how each choice affects the overall outcome.

Students will be using an online activity from the Office of Research Integrity in the Department of Health and Human Services (<http://ori.hhs.gov/thelab>). See the online facilitator’s guide for directions on how to use the online simulation. An overview is included below.

***The Lab: Avoiding Research Misconduct** is a Virtual Experience Interactive Learning Simulation (VEILS) program. Participants will assume one of four playable roles: a graduate student, a postdoctoral student, a principal investigator, or a research integrity officer. In each segment, the character has to make decisions about how to handle possible research misconduct. The story spins off in different directions, depending upon the choices participants make as the character. The decisions that each character makes have consequences that not only affect that character’s*

*future, but also the future of others in the lab. Each choice or combination of choices brings results that must be dealt with. This program includes: Simulation that includes four playable characters; Tutorials for each character that describe a step-by-step way to make ethical decisions; [and] a...facilitator's guide...*

This simulation can be experienced as a group, or participants can do it individually as homework. If participants are doing the simulation together as a group, then play the opening video and choose a character to play that is most applicable to the audience. When the program comes to the first decision point, discuss each option with the group. Poll the participants to see what they want to do, make the choice, and then continue playing until the next decision point. When the group has completed the simulation, present the tutorial for that character and discuss the ethical decision-making model. See the Facilitator's Guide for some of the key decisions, using the questions in this guide to stimulate discussion. Emphasize the key learning points for the character. If participants are assigned to do the simulation as homework, then class discussion can focus on the key decision points and the tutorial.

**REMINDER:** Encourage students to note ideas they want to add to their *My Data Management and Integrity Checklist - Update*.



**Instructor Guide to download**

## Activity C

### Two-Minute Challenges – The Gray Areas in DFF

**Purpose** These case studies will provide examples of scenarios that students may encounter regarding data falsification and fabrication that may not have clear-cut solutions. Students will need to make judgement calls on how to proceed. After completing the activity, students will be able to identify the stakeholders in each scenario, the possible outcomes, and the pros and cons of different approaches to the issue.

- Objectives**
2. Justify why the self-correcting nature of science does not eliminate the scientific community's concerns about data falsification and fabrication.
  3. Identify the stakeholders in DFF and describe the potential outcomes of DFF for each stakeholder.
  4. Explain how applying acceptable standards of practice for maintaining original records and primary data reduce the chances of DFF.
  5. When dealing with a research misconduct concern, identify the relevant personnel at your institution and determine the optimal order in which to approach them.

**Procedure** **Learning Cycle:** This activity should be done in the Elaborate phase. Students can do this individually or in small groups. In small groups, students should read the challenge to the group and then discuss the questions as a group (7-10 minutes). At the end of the exercise, students should write down their thoughts on how to deal with DFF when it occurs, and how to prevent it happening with collaborators and one's trainees; their notes will be used in Activity F.

**HILA:** This activity should be done after the Interactive Lecture. At the end of the exercise, students should write down their thoughts on how to deal with DFF when it occurs, and how to prevent it happening with collaborators and one's trainees; their notes will be used in Activity F.

**Answers for Instructors are provided in *italics*.**

**REMINDER:** *Encourage students to note ideas they want to add to their My Data Management and Integrity Checklist - Update.*

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#### Challenge 1: Sloppy Science

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At the weekly lab meeting, a colleague presents new data showing inhibition of a target gene in a cell line that is very hard to work with. The PI is delighted by the results and wants to include them in his grant proposal due next week. However, you are concerned about these results because the colleague always seems to forget critical steps in protocols. For example, you notice

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that she did not include the necessary controls to confirm the knockdown for the data she presented today.

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**1. Would you say anything during lab meeting? After lab meeting? To whom?**

*Yes, it is good to share your concerns about the data presented. During lab meeting, you could ask your colleague to share the validation data for the experiment. If it is not available during the lab meeting, you could remind your colleague after the meeting that you are interested in seeing the validation data. If the control experiments were not performed or the results are not convincing, it is important to share your concerns with your PI before the grant is submitted.*

**2. Is there any harm to include these “preliminary data” (n=1) in the grant proposal?**

*It depends. If you know that the experiment was not performed properly then the results should not be included in the grant. If, however, the initial experiment was done with the appropriate controls and analyses, then the results may be okay to include in the grant as long as it is declared that the findings are an n=1.*

**3. Are there steps to take to ensure that the preliminary results are reproducible?**

*Yes. The experiments should be repeated to confirm that the results are reproducible.*

**4. When YOU are the PI: How would you assure that your trainees and collaborators understand that sloppy science is not acceptable in your lab? How would you teach this?**

*I would discuss my expectations for performing research in my lab as soon as a potential student or researcher expresses interest in working for me. I would also make “good science” a standard in the lab with defined expectations for running experiments, analyzing data, collaborating, and sharing results. Discussions in lab meetings would be used as a forum to reiterate standards and expectations for preparing data.*

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## Challenge 2: Data Omission

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“I am a bit worried about how my advisor has selected the data to include in my next paper. In general, I believe my results. It is just that not all of my repeats worked and I do not feel confident that someone else could reproduce my work. When experiments are not consistent, my advisor recommends that I just put the data in my drawer and ‘let it sit’ until I have figured out the problem. She says that sometimes it takes years to determine the reason for variability in experiments but you can’t slow down publishing your work because of it.”

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**1. Is this good advice?**

*No, it is not good advice. It is important to understand why experiments are not consistent. It could be a technical error, but, if no error is suspected, then the results could be valid and should not be ignored.*

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**2. Is omitting data good practice?**

*No. Data should not be omitted unless there is a justifiable reason.*

**3. Should you report how many times you repeated an experiment in the manuscript?**

*Yes.*

**4. What other ways can you ensure the data are reproducible?**

*Repeat the experiment and have others in your lab group or a collaborator repeat the experiment.*

**5. When YOU are the PI: How would you assure that your trainees and collaborators understand that data omission is not good practice? How would you teach this?**

*I would ask to see all the data rather than just the overall results during their weekly lab meetings with me. In addition, I would have them show their actual results during group lab meeting rather than the overall results.*

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**Challenge 3: Stressed Out**

As a new PI, you are trying to put together your first RO1 grant proposal but lately everything seems to be holding you back. Your new baby was up all night, the grad student in your lab cannot work fast enough to acquire the preliminary data, and your teaching load increases every time you meet with the Dept. Chair. With all of the late nights you've been putting in, it is hard for you to remember exactly how all of these ideas have made it into your draft proposal. You have never felt more stressed and more alone. The submission deadline is in three days.

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**1. Would you submit the grant proposal?**

*If I was not confident that the information included in the grant reflected my own thoughts and ideas, then I would not submit it.*

**2. Are there resources at your institution to help with the stress?**

*Likely so. There may be a counseling center or resource center that could provide support.*

**3. Are there ways to make your lab environment more supportive?**

*Yes. Perhaps lab members could help with some of the grant writing or at least be useful in discussing and developing the new ideas for the grant.*

**4. When YOU are the PI: How would you balance these demands?**

*I would seek as much personal and professional support as possible. I would try to plan grant applications much farther in advance so that I could do just a little bit at a time. Consider keeping a running log or notebook of research, grant, or paper ideas that arise and date them. Also, identify the expected due date for a grant proposal and create a plan to have the proposal finished in advance, allowing buffer time for emergencies.*

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### Challenge 4: Hypothesis Believer

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“Have you noticed that Bobby, the eager postdoc in the lab, always offers to finish the last part of the experiment for us? I mean it is a nice gesture but the results I obtained when I ran the experiment alone were very different from the data he has been giving us. I, as an early career grad student, would not have thought too much about it, except when I told him that I repeated the experiment over the weekend he got really agitated and asked to see the data. He could not explain why our results are so different. I am just worried that he is so focused on his hypothesis being correct that maybe he is doing something to ‘make’ the data work?”

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**1. Would you ask to see his raw data?**

*Yes. It may be good for you to have a meeting with the postdoc and advisor to go through all of the results and discuss what may have caused the discrepancies.*

**2. Who could you talk to about your concerns?**

*I would share my concerns with my advisor. My advisor could then reach out to the postdoc to inquire about his methods and results.*

**3. What could be implemented in the lab to support best research practices?**

*Since the group is sharing responsibilities for experiments, then the data obtained and protocols used should be stored in a place so that all involved can see the raw data and results.*

**4. PASS IT ON: How will you prevent this type of scenario in your future lab?**

*Answers will vary.*

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### Challenge 5: Sabotage

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“I think I am losing my mind. For the past three mornings, I can’t seem to find my raw data from the previous day. The first time it happened I thought I must have thrown it away by mistake. The second time, I tore apart my desk trying to find it. Last night, I put the data in a drawer and locked it. Now the lock looks damaged and my papers are gone. I am beginning to think that someone does not want me to get the last piece of data I need for the publication.”

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**1. Who do you talk to about your concerns?**

*I would talk to my advisor about the concerns. The advisor should be made aware that someone may be compromising data.*

**2. Would this be considered research misconduct?**

*This would not be considered research misconduct as data have not been plagiarized, falsified, or fabricated. It is considered a criminal act.*

**3. Should you call the police?**

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*Since your locks were tampered with and data are missing, it would be important to contact the police.*

4. **PASS IT ON:** How can the research mentor or PI cultivate a lab environment that discourages this type of illegal behavior?

*Answers will vary.*

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### Challenge 6: Results, as Promised

A fellow grad student provides results to complete your paper. They look picture perfect, just the results you had hypothesized. Even so, you are surprised by how quickly she was able to generate the data, especially when you had so much trouble acquiring similar data. In fact, you were never able to make the experiment work, which is why your advisor asked her to try...just a week ago.

1. **What if your fellow grad student says that she accidentally deleted the raw data and this is the only copy of the results?**

*If the raw data are missing, I would ask her to repeat the experiment. I would not include the results in my paper without seeing the raw data.*

2. **What if she says, “I made the data the way our advisor requested it. Everybody in the lab does that, except for you.”**

*I would be worried. Such a statement suggests that a lot of data from the lab may not be real. It may be a good idea to share your concerns with the graduate chair or dean in the department if you think there is something problematic going on in the lab.*

3. **PASS IT ON:** How will you help your students understand that this is NOT acceptable practice in your lab?

*Answers will vary.*

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## Activity D

### MMR Vaccine and Autism - The Andrew Wakefield Case

**Purpose** Students will explore how DFF can have long term impacts for many stakeholders, including the general population. After completing this activity, students will be able to summarize the outcomes that may result from an investigation of public misconduct and will be able to identify the stakeholders in a misconduct incident.

- Objectives**
1. Define data falsification and fabrication (DFF) and identify examples of each.
  2. Justify why the self-correcting nature of science does not eliminate the scientific community's concerns about data falsification and fabrication.
  3. Identify the stakeholders in DFF and describe the potential outcomes of DFF for each stakeholder.
  6. Summarize the outcomes that may result from an investigation of publication misconduct related to DFF.

**Procedure** **Learning Cycle:** Complete in the Explore phase. Students should do readings individually and can answer questions individually or in class.

**HILA:** Should be done and discussed during or after the Interactive Lecture.

Students should read the article, "The MMR vaccine and autism: Sensation, refutation, retraction, and fraud" as well as at least one of the linked articles on the continuing focus on vaccines and autism in the popular press. Students should answer the questions and discuss them in class either in small groups or during the Interactive Lecture.

**REMINDER:** Encourage students to note ideas they want to add to their *My Data Management and Integrity Checklist - Update*.

## Activity E

### Should Scientists Take an Oath?

**Purpose** Students will explore the idea of scientists taking an oath to adhere to a code of ethics for researchers. After completing this activity, students will be able to discuss the role of honesty and integrity in the advancement of science.

- Objectives**
2. Justify why the self-correcting nature of science does not eliminate the scientific community's concerns about data falsification and fabrication.
  4. Explain how applying acceptable standards of practice for maintaining original records and primary data reduce the changes of DFF.

**Procedure** **Learning Cycle:** Complete in the Elaborate phase OR use as an Engage activity at the start of the module. Students can do this individually or in groups.

**HILA:** Should be done as homework and discussed after the Interactive Lecture.

Students should read the activity, answer the questions, and discuss them as a group.

**REMINDER:** *Encourage students to note ideas they want to add to their My Data Management and Integrity Checklist - Update.*

## Activity F

### My Data Management and Integrity Checklist - Update

**Purpose** Students will develop a checklist based on course material that they can use now and in the future to guide ethical text preparation in terms of reducing the chances of data fabrication and falsification. They should use materials from the activities, readings, and Interactive Lecture. After completing the activity, students should have a checklist for data fabrication and falsification considerations AND a plan for teaching best practices to their students.

**NOTE:** If students have completed the module, “Data Management and Integrity,” they already have developed a checklist for data management. If so, they can use this activity to update and expand their plan. If students do not already have a plan, they can use this activity to start a data management checklist.

**Objectives** 7. Develop or update a best practices checklist for data management and storage to reduce the chances of DFF.

**Procedure** **Learning Cycle:** Complete in the Evaluate phase. Students should do this individually but will want to share their checklists with the instructor.  
**HILA:** Should be done following the Interactive Lecture. Students should do this individually but will share their checklists with the instructor

At the end of the module, students should develop a checklist (or add to their previous data management/storage checklist) of strategies they have learned from this module or developed themselves for preventing data falsification and fabrication in their work.

**Encourage students to include the following in their plan:**

- Definitions and examples of data fabrication and data falsification.
- Whom to contact if they have concerns about the integrity of research in their lab.
- A description of (or update of) their data management and storage plan to help prevent fabrication and falsification.



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### Whom Do You Tell about Your Concerns?

- Share your concerns with a trusted advisor. Concerns should not be discussed widely.
  - PhD mentor or research advisor
  - Graduate program director
  - Department chair
- Seek advice from someone outside of the department, particularly...
  - Dean of the graduate school
  - Research Integrity Officer

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### Research Integrity Officer



- Receives inquiries regarding potential research misconduct
  - interview
- Initiates an investigation
  - collect and preserve evidence
  - interview persons accused of misconduct
- Establishes expert committee to review evidence and make formal findings
  - recommendations
  - loss or denial of appointment
  - loss of grant funding
  - retract or correct articles
- Protects the accuser (whistleblower)
  - maintain confidentiality
  - relocate to new research facility

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### Let's (Re)view the Video "The Lab: Avoiding Research Misconduct"




**WATCH & DISCUSS**

- Does anyone have comments on the video?
- Did you try out more than one character?
- Any questions or concerns?

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### MMR Vaccine and Autism - The Andrew Wakefield Case



1998: Paper published claiming that MMR vaccine increases the risk of autism and bowel disease.

1998-2004: Other scientists do not find a link between MMR vaccine and autism.

2004: Investigation by a journalist reports that the study was fraudulent.

2004: Article was retracted by co-authors.



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### Small Group Activities

Your instructor will provide directions for these activities



**DISCUSS**

- These activities will help you APPLY what you have learned so far to common scenarios.
- BE SURE to add notes from this presentation to your "My Publications: Best Practices" document.

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### Data Fabrication and Falsification

- Access more APS Professional Skills Training Courses at [www.the-physiological.org](http://www.the-physiological.org)
- The module is part of a series of seven teaching modules designed to promote best practices in publication ethics for life scientists and biomedical engineers who publish research papers. The modules were developed with support from the National Science Foundation (NSF) (IIS-1226348) and in collaboration with staff and members of the APS, BMES, and SBE. The modules represent the views of the authors and do not necessarily represent the views of NSF, APS, BMES, or SBE. The information in these modules is designed to represent a summary of good practices and advice at the time of publication. They are not meant to serve as legal advice or publisher policy and do not in any way guarantee protection from professional ethics charges.
- For more information on how the materials were developed and tested, please contact the authors.

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## Presentation Slide Text

Slide #	Text
1	<p>This presentation is part of the professional skills training series on professional integrity best practices for publishing your research.</p> <p>Today we will review best practices for addressing concerns regarding research misconduct, particularly for data fabrication and falsification. This presentation will help you to:</p> <ul style="list-style-type: none"> <li>• <b>Define</b> data fabrication and falsification;</li> <li>• <b>Justify</b> why the self-correcting nature of science does not eliminate concerns about data fabrication and falsification;</li> <li>• <b>Identify and describe</b> outcomes of those who are affected by data fabrication and falsification;</li> <li>• <b>Explain</b> how maintaining records and primary data reduce the chances of data fabrication and falsification;</li> <li>• <b>Identify</b> the relevant personnel at your institution that will help you deal with a research misconduct concern and <b>determine</b> the optimal order in which to approach them;</li> <li>• <b>Summarize</b> the outcomes that may result from an investigation of publication misconduct related to data fabrication and falsification; and</li> <li>• <b>Develop or update</b> your good practices checklist for data management and storage to reduce the chances of data falsification and fabrication.</li> </ul>
2	<p>For homework, you were asked to provide an example of a research integrity issue that was recently highlighted in the media.</p> <p>Did you consider: What concerns were identified? What went wrong? Who was at fault? Whether it involved published articles or grants?</p> <p>Even though lapses in research integrity affect a minority of studies, the reporting of these incidents by the media places the entire scientific community in a negative light. Thus, it is important to protect the integrity of your research as much as you can and speak up when you have concerns about the work of others.</p>
3	<p>Fabrication and falsification are two terms that often describe research misconduct regarding data.</p> <p>Data fabrication is defined as making up data or results AND recording or reporting them. That is, the researcher creates, invents, or constructs data and results without actually doing the experiment.</p>

	<p>For example, this image was submitted to a journal for publication. The art editors had concerns about the image because the bands seemed to be sitting on a different background rather than having a consistent pattern throughout the entire image. When the editor inquired, the authors admitted that they created the image to make it look like the data they wanted to report in the manuscript. That is, they fabricated the data.</p>
<p><b>4</b></p>	<p>Data falsification is defined as manipulating, modifying, or changing data or results such that the results are not accurate representations of the actual data.</p> <p>This is an example of falsified data submitted to a journal. It looks like data derived from a legitimate experiment. However, once the art staff started preparing the figures for publication, they found evidence that the figures had been manipulated inappropriately.</p> <p>The editor asked the authors for the original captures and the authors provided them. However, as you can see, it was clear that image prepared for publication did not accurately represent the original data. Photo-editing cannot be used to make poor data into good data. If the data are not good enough for publication, repeat the experiment.</p> <p>Because scholarly knowledge builds on the work of others, publishing fabricated or falsified data may disrupt the productivity of many other researchers. Funding, research effort, and time, are wasted by those trying to repeat faulty conclusions. If you envision research as a pyramid with new work, studies, and papers building on the foundation built by previous studies, what is the impact on the pyramid if one or several of the foundational blocks are removed, that is, proven to be false? The assumptions and conclusions that led to many of the studies are now missing. Imagine how you would feel if the manuscript on which you based your hypothesis and thesis work was found to be fabricated or falsified. How would that affect the validity and impact of your work?</p> <p>Making up or manipulating data for grant applications, or scholarly publications, is considered research misconduct. It is an extremely serious offense. Findings of research misconduct can disrupt or end a scientific career. It can also result in prison time.</p>
<p><b>5</b></p>	<p>Concerns about research integrity WILL happen during your career. Ideally, it will not be related to you. But you may find concerns in your role as a journal reviewer or as a grant reviewer. Even as a reader of scholarly articles, you may find data or text that seem unbelievable or look manipulated.</p> <p>When such concerns arise, inform the journal editors or the granting agency about</p>

	<p>your concerns. They will determine how best to address the matter. It will not be your responsibility to deal with the authors and it is unlikely that the authors will ever know that you are the person who pointed out the issue.</p>
<b>6</b>	<p>Some of you may experience concerns about research misconduct in your own lab. What do you do?</p> <p>This is a delicate situation. The people in your lab are colleagues, friends, role models, and advisors. They are people you work with every day. You trust their professional ethics just as they trust yours.</p> <p>First, ask questions. Many concerns are resolved just by asking for more information about an experiment or for clarification about what was done or what is being shown in a figure or table.</p> <p>Ask to sit down with the person to see the data or the results. The problem may have been caused by a simple error. You may find that your colleagues are not using good data preparation practices. Now is the time to let them know that a certain practice may be considered falsification or fabrication.</p> <p>It is far better to raise a concern before suspect data are submitted in a grant or journal.</p>
<b>7</b>	<p>If a concern is more serious than a simple conversation with a colleague, then you should share your concerns privately with a trusted advisor.</p> <p>This advisor should be someone you believe will listen to your concerns and be willing to assess the problem.</p> <p>The first person to consider is your PhD mentor or research advisor. However, if you think the concern may involve your advisor, consider reaching out to the director of the graduate program or your department chair.</p> <p>If you are concerned about approaching someone within your department or research environment, then consider contacting the Dean of the Graduate School or the Research Integrity Officer.</p>
<b>8</b>	<p>The Research Integrity Officer, the RIO, is the person at your institution who is best prepared to address serious concerns about research misconduct. They often work in the Office of Research, the Vice President's Office, or the administrative office that facilitates Responsible Conduct of Research training.</p> <p>The RIO will listen to your concerns and discuss what the appropriate next steps</p>

	<p>should be. They may encourage you to discuss the concerns with your advisor or initiate a formal complaint.</p> <p>If the concerns are very serious, the RIO will initiate an investigation. The investigation may involve the police coming into the lab with the RIO to collect data from notebooks and computers. It may require interviews with the accused or others associated with the situation.</p> <p>A committee of experts will review the concerns and evidence and make a ruling about whether research misconduct took place.</p> <p>Those found guilty of research misconduct may receive a formal reprimand, lose their academic appointments, lose grant funding, or lose credit for published work.</p> <p>If you bring the concern to the RIO and your lab is called into question, your research environment may be disrupted. Thus, the RIO will protect the accuser as much as possible by maintaining confidentiality and relocating them to a safe research environment.</p>
<b>9</b>	<p>Raising concerns about your lab or someone else's research practices is a big deal, so why not just stay quiet and wait it out? After all, you may only need a few years to complete your PhD or postdoc, or to secure tenure.</p> <p>If you choose to stay quiet, bad practices will continue to go unchecked and will grow with time. And practices that are already part of the lab culture will continue after you leave. The next graduate student will be faced with the same dilemma. And what about the publications from the lab? Would you want fraudulent data to continue to be published? Remember the pyramid model we described earlier and imagine the impact of fraudulent data on your research area. Do you want your name attached to fabricated or falsified data? Do you want your name associated with a lab that falsifies data?</p> <p>Of course, you have to protect yourself and your career. If possible, you should report research misconduct concerns to someone at your institution even if you wait until AFTER you graduate.</p> <p>For homework, you were asked to watch the video, "The Lab: Avoiding Research Misconduct." It was developed by the Office of Research Integrity at the National Institutes of Health to depict how concerns about research misconduct can affect all members of a lab, including the graduate students, postdocs, and PIs. It also shows how the RIO works to address the concern.</p>

<b>10</b>	<p>One very sensational example of research misconduct involves a publication that reported that the Measles, Mumps, and Rubella vaccine, the MMR vaccine, causes Autism. Dr. Andrew Wakefield first published these findings in 1998. However, other scientists were unable to repeat the findings and an investigative journalist eventually uncovered that the entire study was fabricated. The article was retracted in 2004, six years after it was published.</p> <p>Unfortunately, the link between the MMR vaccine and autism is still being reported as fact in the public, leading many parents to decline vaccinating their children. This false report has risked the health of many children and has played into the fears of parents who are trying to understand the cause of their child's autism.</p>
<b>11</b>	<p>The remaining activities in this module will help you to APPLY what you have learned so far to common scenarios and to your own work.</p> <p>BE SURE to add notes from this presentation to your "My Checklist" document.</p>
<b>12</b>	<p>Thank you for listening to this presentation. To access more information about APS Professional Skills Training Courses visit <a href="http://www.the-aps.org/pst">www.the-aps.org/pst</a>.</p>

## References and Resources

1. Case Summaries. Office of Research Integrity. Office of Research Integrity. Retrieved from: <https://ori.hhs.gov/definition-misconduct>.
2. Code of Federal Regulations, Part 93-Public Health Service Policies On Research Misconduct. Retrieved from: <https://www.ecfr.gov/cgi-bin/text-idx?SID=e8718c89f83236fb16393e2def2580a5&mc=true&node=pt42.1.93&rgn=div5#se42.1.931103>.
3. Definition of Research Misconduct. Office of Research Integrity. Retrieved from: <https://ori.hhs.gov/definition-misconduct>.

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## Course Resources

Each of the **Professional Skills Training Courses on Best Practices for Publishing Your Research** has multiple resources to accompany the Instructor Guide. All of the following resources are available at [www.the-aps.org/pst/ethics](http://www.the-aps.org/pst/ethics).

1. PowerPoint (.ppt) files for the Interactive Lecture. These slides are editable.
2. Instructor and Student Guides are available as editable .doc files.
3. Request form for assessment tools (quizzes and key).
4. Links to video versions of the Interactive Lecture on YouTube.
5. Links to online, on demand version of the module.

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### Publication Ethics Community

In addition, APS hosts a Publication Ethics Community on the Life Science Teaching Resource Community. The community posts ethics cases for comment by participants and experts. See [www.lifescitrc.org](http://www.lifescitrc.org) and click on My Community.

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### Ethics CORE (Collaborative Online Resource Environment)

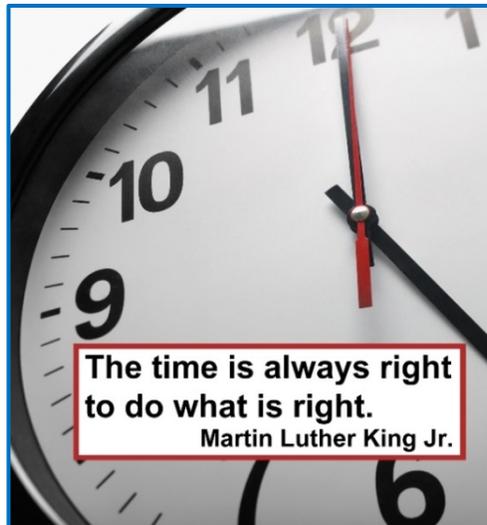
This website is coordinated by the National Center for Professional and Research Ethics. The site provides resources for Responsible Conduct of Research courses and seeks to create communities of responsible research and professional practice. It is an excellent source of case studies, simulations, role-play scenarios, videos, and lectures. See <https://nationalethicscenter.org>.

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We welcome your questions and feedback on these materials.  
Email us at [education@the-aps.org](mailto:education@the-aps.org).

## Data Fabrication and Falsification Module

# Student Handouts



### These activities will help you:

1. Define data falsification and fabrication (DFF) and identify examples of each.
2. Justify why the self-correcting nature of science does not eliminate the scientific community's concerns about data falsification and fabrication.
3. Identify the stakeholders in DFF and describe the potential outcomes of DFF for each stakeholder.
4. Explain how applying acceptable standards of practice for maintaining original records and primary data reduce the chances of DFF.
5. When dealing with a research misconduct concern, identify the relevant personnel at your institution and determine the optimal order in which to approach them.
6. Summarize the outcomes that may result from an investigation of publication misconduct related to DFF.
7. Develop or update your best practices checklist for data management and storage to reduce the chances of DFF.

This module is part of the series, *“Professional Integrity: Best Practices for Publishing Your Research”* developed by:

American Physiological Society [www.the-aps.org](http://www.the-aps.org)

Biomedical Engineering Society [www.bmes.org](http://www.bmes.org)

Society for Biological Engineering [www.aiche.org/sbe](http://www.aiche.org/sbe)

For information on the other modules or to take an online, interactive version of one or more modules, go to [www.the-aps.org/pst](http://www.the-aps.org/pst).

## About Your Publication Ethics Checklists

In these modules, you will be encouraged to create your OWN checklists for preparing manuscripts using ethical and professional standards of practice for researchers.



WRITE

### Why do I need a checklist?

As your training progresses, your research and writing skills develop along with your knowledge of the field, your professional network, and your independence as a professional. This also means that understanding and following best practices for professional behavior, including research and publication ethics, increasingly rests on your shoulders. YOU become the person who is setting the standards for your laboratory group. YOU are the person who must establish protocols for assuring ethical behavior. And YOU are the person who has to teach standards and protocols to every trainee in your lab and, sometimes, to those with whom you collaborate. You cannot assume that they come with an understanding of best practice...you must inform, guide, and monitor their adherence to best practices.

### What should I include in the checklist?

You are investing time and effort to learn best practice for publication ethics through this module (and possibly the other modules in this series). **This activity is the big “take away” from this module.** It is YOUR checklist of things to remember about publication ethics. In each module in this series, you will add a checklist of the things you want to remember from that module. You also will add notes on how you would teach this to your students in the future. For most modules, we encourage you to add three sections to your checklist:

- 1. Definitions to Remember Table:** Consider adding the terms and definitions from the lecture. Also add the links for professional standards you want to access later (e.g., ICMJE criteria for authorship). Remember to add the source of your definition or text if you are copying it.
- 2. My Best Practices Checklist:** What are the things you want to check as you develop or revise your manuscripts?
- 3. PASS IT ON:** How will you teach this to YOUR trainees in the future? How will you share this with those with whom you collaborate?

When you are done with these modules, we encourage you to make a copy of your checklists and keep them handy for use as you develop manuscripts in the future.

## Activity A

### Ethics in the News

**Purpose** This activity will increase your awareness of research integrity issues in the public eye and the consequences of ethics violations. After completing this activity, you should be able to identify examples of data falsification and fabrication (DFF), identify the stakeholders in each research integrity case, and describe the consequences of the ethical violation.

**Procedure** Find an example of a research integrity issue that was recently highlighted in the media and answer the questions on the worksheet below.



WRITE

Bring a copy of the article AND your answers to class.

**Hint:** Try searching for “research misconduct in news.”

1. Write the reference for your article here. Be sure to include author, title, publication, date, and source (URL).
2. In the article, what concerns were identified?
3. What went wrong? What is the problem?
4. Who was found to be at fault?

5. Does the concern involve published articles or grants?
  
6. Is there a lab best practice that could have prevented this from happening?



WRITE

**REMEMBER:** Note ideas that you want to add to your My Data Management and Integrity Checklist - Update.

## Activity B

### “The Lab – Avoiding Research Misconduct”

**Purpose** This activity encourages you to consider the consequences of research misconduct AND how your own choices and communication strategies can lead to difficulties in professional ethics. After completing this activity, you will recognize how research misconduct can affect both you and others, even if you are not the person guilty of misconduct. You will also understand how small decisions can contribute to larger ethical decisions.

**Procedure** You will be using an online activity from the Office of Research Integrity in the Department of Health and Human Services (<http://ori.hhs.gov/thelab>).



WATCH

First, watch the intro video. Your instructor will tell you whether you are doing this simulation as a group, in small groups, or individually.

No matter how you do the simulation in class, you are encouraged to try out all the roles and decisions to better understand how each can contribute to avoiding or creating a professional ethics problem in the lab.



WRITE

**REMEMBER:** Note ideas that you want to add to your My Data Management and Integrity Checklist - Update..

## Activity C

### Two-Minute Challenges - The Gray Areas in DFF

**Purpose** These case studies will provide examples of scenarios that you may encounter regarding data fraud and fabrication that may not have clear-cut solutions. You will need to make judgement calls on how to proceed. After completing the activity, you will be able to identify the stakeholders in each scenario, the possible outcomes, and the pros and cons of different approaches to the issue. You will also understand how maintaining records and primary data appropriately can reduce the chances of DFF.

**Procedure** You can do this activity individually or in groups, as directed by your instructor.



Read the challenge to the group and then discuss the questions as a group (7-10 minutes).

DISCUSS

At the end of the exercise, write down your thoughts on how to deal with DFF when it occurs, and how to prevent it with your collaborators and trainees. You will use these notes in Activity F.



**REMEMBER:** Note ideas that you want to add to your My Data Management and Integrity Checklist - Update.

WRITE

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### Challenge 1: Sloppy Science

---

At the weekly lab meeting, a colleague presents new data showing inhibition of a target gene in a cell line that is very hard to work with. The PI is delighted by the results and wants to include them in his grant proposal due next week. However, you are concerned about these results because the colleague always seems to forget critical steps in protocols. For example, you notice that she did not include the necessary controls to confirm the knockdown for the data she presented today.

---

1. **Would you say anything during lab meeting? After lab meeting? To whom?**
  2. **Is there any harm to include these “preliminary data” (n=1) in the grant proposal?**
  3. **Are there steps to take to ensure that the preliminary results are reproducible?**
  4. **PASS IT ON:** How would you assure that your trainees and collaborators understand that sloppy science is not acceptable in your lab? How would you teach this?
-

---

## Challenge 2: Data Omission

---

“I am a bit worried about how my advisor has selected the data to include in my next paper. In general, I believe my results. It is just that not all of my repeats worked and I do not feel confident that someone else could reproduce my work. When experiments are not consistent, my advisor recommends that I just put the data in my drawer and ‘let it sit’ until I have figured out the problem. She says that sometimes it takes years to determine the reason for variability in experiments but you can’t slow down publishing your work because of it.”

---

1. Is this good advice?
  2. Is omitting data good practice?
  3. Should you report how many times you repeated an experiment in the manuscript?
  4. What other ways can you ensure the data are reproducible?
  5. **PASS IT ON:** How would you assure that your trainees and collaborators understand that data omission is not good practice? How would you teach this?
-

---

### Challenge 3: Stressed Out

---

As a new PI, you are trying to put together your first RO1 grant proposal but lately everything seems to be holding you back. Your new baby was up all night, the grad student in your lab cannot work fast enough to acquire the preliminary data, and your teaching load increases every time you meet with the Dept. Chair. With all of the late nights you've been putting in, it is hard for you to remember exactly how all of these ideas have made it into your draft proposal. You have never felt more stressed and more alone. The submission deadline is in three days.

---

1. **Would you submit the grant proposal?**
2. **Are there resources at your institution to help with the stress?**
3. **Are there ways to make your lab environment more supportive?**
4. **PASS IT ON:** How would you balance these demands?

---

**Challenge 4: Hypothesis Believer**

---

“Have you noticed that Bobby, the eager postdoc in the lab, always offers to finish the last part of the experiment for us? I mean it is a nice gesture but the results I obtained when I ran the experiment alone were very different from the data he has been giving us. I, as an early career grad student, would not have thought too much about it, except when I told him that I repeated the experiment over the weekend he got really agitated and asked to see the data. He could not explain why our results are so different. I am just worried that he is so focused on his hypothesis being correct that maybe he is doing something to ‘make’ the data work?”

---

1. **Would you ask to see his raw data?**
2. **Who could you talk to about your concerns?**
3. **What could be implemented in the lab to support best research practices?**
4. **PASS IT ON:** How will you prevent this type of scenario in your future lab?

---

**Challenge 5: Sabotage**

---

“I think I am losing my mind. For the past three mornings, I can’t seem to find my raw data from the previous day. The first time it happened I thought I must have thrown it away by mistake. The second time, I tore apart my desk trying to find it. Last night, I put the data in a drawer and locked it. Now the lock looks damaged and my papers are gone. I am beginning to think that someone does not want me to get the last piece of data I need for the publication.”

---

1. Who do you talk to about your concerns?
  2. Would this be considered research misconduct?
  3. Should you call the police?
  4. **PASS IT ON:** How can the research mentor or PI cultivate a lab environment that discourages this type of illegal behavior?
-

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**Challenge 6: Results, as Promised**

---

A fellow grad student provides results to complete your paper. They look picture perfect, just the results you had hypothesized. Even so, you are surprised by how quickly she was able to generate the data, especially when you had so much trouble acquiring similar data. In fact, you were never able to make the experiment work, which is why your advisor asked her to try...just a week ago.

---

1. **What if your fellow grad student says that she accidentally deleted the raw data and this is the only copy of the results?**
  2. **What if she says, “I made the data the way our advisor requested it. Everybody in the lab does that, except for you.”**
  3. **PASS IT ON:** How will you help your students understand that this is NOT acceptable practice in your lab?
-

## Activity D

### MMR Vaccine and Autism - The Andrew Wakefield Case

**Purpose** You will explore how DFF can have long-term impacts for many stakeholders. After completing this activity, you will be able to summarize the outcomes that may result from an investigation of public misconduct and will be able to identify the stakeholders in a misconduct incident.

**Procedure** Read the article, “The MMR vaccine and autism: Sensation, refutation, retraction, and fraud” (attached or linked below).



READ

ALSO read at least one of the linked articles on the continuing focus on vaccines and autism. Answer the questions below and bring them to class for discussion.

#### Articles

1. Sathyanarayana Rao T S, Andrade C. The MMR vaccine and autism: Sensation, refutation, retraction, and fraud. *Indian J Psychiatry* [serial online] 2011 [cited 2017 Mar 3]; 53:95-6. Available from: <http://www.indianjpsychiatry.org/text.asp?2011/53/2/95/82529>
2. Centers for Disease Control (CDC). Understanding MMR Vaccine Safety. CDC: Atlanta, GA. 2013, February. Available from: <https://www.cdc.gov/vaccines/hcp/conversations/downloads/vacsafe-mmr-color-office.pdf>
3. Downs, M. Autism-vaccine link: evidence doesn't dispel doubts. *WebMD Special Report*. Undated. Available from: <http://www.webmd.com/brain/autism/searching-for-answers/vaccines-autism?page=1>
4. Focus for Health. Autism and the Vaccine Debate. Undated. [https://www.focusforhealth.org/autism-and-vaccine-debate/?gclid=Cj0KEQjAxeTFBRCGmlq\\_7rGt\\_r8BEiQANdPqUsbMI12b-aAFieqsORW7YmUK0vKpzOKae07LEd664iEaAu8K8P8HAQ](https://www.focusforhealth.org/autism-and-vaccine-debate/?gclid=Cj0KEQjAxeTFBRCGmlq_7rGt_r8BEiQANdPqUsbMI12b-aAFieqsORW7YmUK0vKpzOKae07LEd664iEaAu8K8P8HAQ)
5. Jameson, C. Vaccines cause autism. *Age of Autism: Daily Web Newspaper of the Autism Epidemic*. 2014, August 24. Available from: <http://www.ageofautism.com/2014/08/vaccines-cause-autism.html>

## Questions

1. Why do you think *Lancet* published the Wakefield paper in the first place?
2. It took six years for the initial retraction of the “causal link” assertion by 10 of the 12 original authors and 12 years for *Lancet* to retract the article. What impacts did the initial paper have on research in that time period?
3. What impacts did it have on public perception of vaccine safety?
4. You were asked to read at least one of the linked articles that were written by bloggers, private health advocacy groups, WebMD, and the CDC. If you were NOT a scientist, how would you interpret these articles when considering getting your young child vaccinated?
5. List the stakeholders affected by the DFF published in the *Lancet* article. For each, list one or more impacts of this DFF incident.



WRITE

**REMEMBER:** Note ideas that you want to add to your My Data Management and Integrity Checklist - Update.

## Activity E

### Should Scientists Take an Oath?

**Purpose** You will explore the idea of scientists taking an oath to adhere to a code of ethics for researchers. After completing this activity, you will be able to discuss the role of honesty and integrity in the advancement of science.

**Procedure** Read the information below about oaths for scientists and complete the questions that follow.



Bring your answers to class and be prepared to discuss.

**DISCUSS** **Please note:** There are NO correct answers to these questions...they are asking for YOUR opinion!

---

#### What is Your Opinion? Should Scientists Take an Oath?

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Traditionally, physicians have taken the Hippocratic Oath (or some version of it) describing the values they will adhere to in the treatment of patients. There has been considerable discussion of whether there should be a similar oath for scientists (see References below).

The United Kingdom (UK) set a “universal code of ethics for scientists” that says scientists should:

- Act with skill and care in all scientific work. Maintain up to date skills and assist their development in others.
- Take steps to prevent corrupt practices and professional misconduct. Declare conflicts of interest.
- Be alert to the ways in which research derives from and affects the work of other people, and respect the rights and reputations of others.
- Ensure that your work is lawful and justified.
- Minimise and justify any adverse effect your work may have on people, animals and the natural environment.
- Seek to discuss the issues that science raises for society. Listen to the aspirations and concerns of others.
- Do not knowingly mislead, or allow others to be misled, about scientific matters. Present and review scientific evidence, theory or interpretation honestly and accurately. ([http://blogs.nature.com/news/2007/09/hippocratic\\_oath\\_for\\_scientist.html](http://blogs.nature.com/news/2007/09/hippocratic_oath_for_scientist.html))

Boston researchers Ravid and Wolozin, wrote a modified Hippocratic Oath for scientists (see box below), stating that, “We believe this oath provides a good foundation for the current generation

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of scientists, and will help to inspire graduates to reach for their highest ideals as they continue in their careers” (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3910371/>). Some research departments use some type of oath when graduate students receive their lab coats and begin their research work.

### Oath of the Scientist

**By accepting my Doctor of Philosophy degree, I earnestly assert that**

- **I will apply my scientific skills and principles to benefit society;**
- **I will continue to practice and support a scientific process that is based on logic, intellectual rigor, personal integrity, and an uncompromising respect for truth;**
- **I will treat my colleagues’ work with respect and objectivity;**
- **I will convey these scientific principles in my chosen profession, in Mentoring, and in public debate;**
- **I will seek to increase public understanding of the principles of science and its humanitarian goals.**

**These things I do promise.**

Ref: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3910371/>

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## Questions

1. Do you think that oaths, such as the Hippocratic Oath for physicians and the Attorney’s Oath for lawyers can help people adhere to professional standards of practice? If so, how much?
  
2. What do you think of the UK code of ethics (above)? Do you think it applies to you and your work?
  
3. What do you think of the Ravid and Wolozin oath?

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4. Would you feel comfortable taking an oath such as this one? Why or why not? Would it be meaningful to you as a scientist?
  5. Would you want the students in your lab to take a similar oath? Why or why not?
- 



WRITE

**REMEMBER:** Note ideas that you want to add to your My Data Management and Integrity Checklist - Update.

## References

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## Activity F

### My Data Management and Integrity Checklist - Update

**Purpose** In this activity, you will use what you have learned to establish or refine a plan for data management to help prevent data fabrication and falsification. If you have already started a checklist for data management and integrity, you can update it with any new information gained from this module. After completing the activity, you should have a plan and a checklist for data management to prevent data fabrication and falsification AND a plan for teaching best practices to your students. You also should be ready to share your plan with collaborators.

**Procedure** Look back at your previous work, readings, and the Interactive Lecture. First, add some important definitions and links to your checklist and then use the following Guiding Questions to develop your policy.

Discuss your plan with your instructor.

Definitions and Resources to Remember	
Definition of data fabrication	
Definition of data falsification	
Who is the Research Integrity Officer at my institution? What is his/her email?	

#### Guiding Questions: Reducing the chance of data fabrication and falsification

1. How can I strengthen my data storage and management procedures to reduce the chance of data fabrication or falsification by collaborators?

2. What procedures will I use with my students and collaborators to reduce the chances that data in collaborative work have be fabricated or falsified?
  
3. If I suspect data fabrication, falsification, or other research misconduct in my lab or in the work of those with whom I collaborate, who are the people I can contact for guidance?
  
4. Do I have a trusted senior colleague at another institution with whom I can discuss concerns confidentially? (Note: This is not the person who can take action but it is important to have more senior colleagues you can trust to help you gauge the seriousness of the possible misconduct).
  
5. **PASS IT ON:** How will I teach my students about DFF? How will I teach them my policies on data management?





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### Whom Do You Tell about Your Concerns?

- Share your concerns with a trusted advisor. Concerns should not be discussed widely.
  1. PhD mentor or research advisor
  2. Graduate program director
  3. Department chair
- Seek advice from someone outside of the department, particularly...
  1. Dean of the graduate school
  2. Research Integrity Officer

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### Research Integrity Officer



- Receives inquiries regarding potential research misconduct
  - anonymous
  - suspicion
- Substantiates an investigation
  - collect and examine evidence
  - interview persons accused of misconduct
- Establishes expert committee to review evidence and make formal findings
  - formal report
  - lose academic appointment
  - lose grant funding
  - retract or correct articles
- Protect the accused (whistleblower)
  - maintain confidentiality
  - relocate to new research facility

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### Let's (Re)view the Video "The Lab: Avoiding Research Misconduct"




**WATCH & DISCUSS**

- Does anyone have comments on the video?
- Did you try out more than one character?
- Any questions or concerns?

<http://orihhs.gov/theLab>

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### MMR Vaccine and Autism - The Andrew Wakefield Case

1998: Paper published claiming that MMR vaccine increases the risk of autism and bowel disorders.

1998-2004: Other scientists do not find a link between MMR vaccine and autism.

2004: Investigation by a journalist reports that the study was fraudulent.

2004: Article was retracted by co-authors.

MMR (measles, mumps, rubella)  
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### Small Group Activities

Your instructor will provide directions for these activities

DISCUSS

- These activities will help you APPLY what you have learned so far to common scenarios.
- BE SURE to add notes from this presentation to your "My Publications Best Practices" document.

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### Data Fabrication and Falsification

- Access more APS Professional Skills Training Courses at [www.the-aps.org](http://www.the-aps.org)
- This module is part of a series of seven teaching modules designed to promote best practices in publication ethics for life scientists and biomedical engineers who publish research papers. The modules were developed with support from the National Science Foundation (NSF) (#SES-1238368) and in collaboration with staff and members of the APS, BMES, and SBE. The modules represent the views of the authors and do not necessarily represent the views of NSF, APS, BMES, or SBE. The information in these modules is designed to represent a summary of good practices and advice at the time of publication. They are not meant to serve as legal advice or publisher policy and do not in any way guarantee protection from professional ethics charges.
- For more information on how the materials were developed and tested, please contact the authors.

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# The time is always right to do the right thing.

—Martin Luther King Jr.

**DATA FABRICATION AND FALSIFICATION** is one of seven teaching modules designed to promote best practices in publication ethics for life scientists and biomedical engineers who publish research papers. Each module provides information on and principles of the most common publication ethics issues as well as the tools needed to integrate and apply professional standards of practice to real life situations. After finishing each module, students will have a personal checklist to use in the preparation of future manuscripts AND a plan for teaching module principles to their future trainees and collaborators.

Modules are designed to be used by higher education institutions, laboratory groups, individuals, and professional societies. The teaching paradigms used in the modules support various types of learners and were designed to integrate into current Responsible Conduct of Research (RCR) training courses/programs.

Modules were developed with support from the National Science Foundation (NSF) (#SES -1238368) and in collaboration with staff and members of the American Physiological Society, Biomedical Engineering Society, and the Society for Biological Engineers.

Handouts for instructor and students, audio and video resources, and online course links are available at [www.the-aps.org/pst](http://www.the-aps.org/pst) for all seven modules:

- Authorship
- Conflicts of Interest
- Considerations for Animal and Human Studies
- Data Fabrication and Falsification
- Data Management and Integrity
- Overlapping Publications
- Text Preparation and Avoiding Plagiarism