

# VANDERBILT SUMMER SCIENCE ACADEMY

## RESPONSIBLE CONDUCT OF RESEARCH

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# Outline

- What is Responsible Conduct of Research?
- Why do we need training in Responsible Conduct of Research?
- Components of Responsible Conduct of Research
  - *Core components*
  - *More about Research Misconduct*
  - *What should I be thinking about this summer?*

# What is Responsible Conduct of Research?

- Do good work
- Show respect for others
- Exercise social responsibility

# *What is Responsible Conduct?*

## Do Good Work

- Have passion for your work
  - *Care about the quality and impact of your work*
- Become an expert and use best practices
  - *Design*
  - *Conduct*
  - *Analysis/interpretation*
  - *Dissemination of results*
- Honesty in all aspects of your work

*What is Responsible Conduct?*


# Show Respect for Others

- Collegiality
- Protection of human and animal subjects
- Compliance with institutional, professional, and governmental regulations and policies

*What is Responsible Conduct?*

## Exercise Social Responsibility

- Relevant, significant hypotheses, questions, and purposes
- Appropriate dissemination of scholarly work
- Active participation in the work of the scientific community



# **Why do we need training in Responsible Conduct of Research?**

“With growing public support for research has come an understandable concern about the way it is conducted. Public funds support roughly one-third of all research and development (R&D) in the U.S. and half of all basic research.

Many researchers, therefore, spend a significant portion of their time working for the public. As public servants and also professionals, researchers have clear obligations to conduct their research in a responsible manner.”

“However, the specifics of good citizenship in research can be a challenge to understand and put into practice.”

Steneck, N. (2007). [\*ORI Introduction to the Responsible Conduct of Research\*](#). Washington, D.C.: Health and Human Services.



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**Ignorance does not excuse inappropriate behavior/practices**

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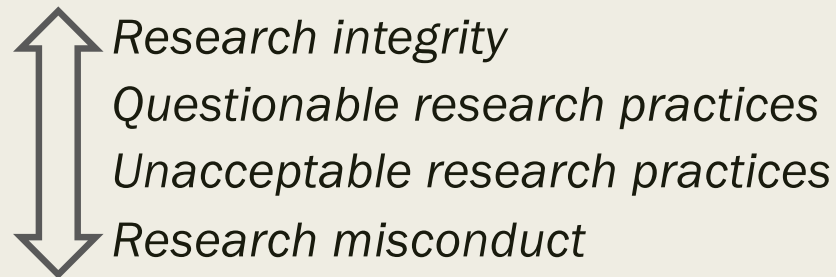
# **Components of Responsible Conduct of Research**

# Responsible Conduct of Research

- research misconduct;
- data management - i.e., data acquisition, record-keeping, retention, ownership, analysis, interpretation, and sharing;
- scientific rigor and reproducibility;
- responsible authorship and publication;
- peer review;
- conflicts of interest in research;
- mentor/mentee responsibilities and relationships;
- collaborative science;
- civility issues in research environments, including but not limited to, harassment, bullying, and inappropriate behavior;
- policies regarding laboratory safety, biosafety, and human and animal research subjects

# Research Misconduct

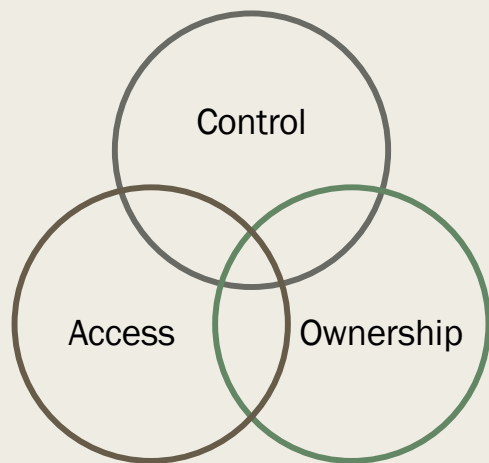
- Continuum from research integrity to misconduct



- Definition of Misconduct,
  - *Fabrication – make-up data or results*
  - *Falsification – manipulate data inappropriately*
  - *Plagiarism – steal another person’s work*

Definition of misconduct, U.S. Office of Research Integrity  
<https://ori.hhs.gov/research-misconduct>

# Data Management



Data management is a general term that refers to the control, access, and ownership of research data

- Control refers to data collection, storage, security, disaster recovery, and retention
- Access refers to which persons may use the data under which conditions
- Ownership refers to legal rights to the data

# Scientific Rigor and Reproducibility

- Rigorous experimental design/statistical analysis
- Transparency in reporting
  - *Replicates*
  - *Statistics*
  - *Randomization*
  - *Blinding*
  - *Sample-size estimation*
  - *Inclusion and exclusion criteria*
- Data and material sharing

# Publication and Authorship

- Researchers should observe the authorship policies established by the journals and other venues in which they publish
- Authors should not:
  - *Submit a manuscript to more than one journal at the same time*
  - *Engage in duplicate publication*
  - *Submit a manuscript or other work without the explicit approval of all authors*

# Peer Review

## Peer review

- Helps establish the quality of the research and manuscript – it is judged by experts
- Contributes to fair editorial decisions about what does and does not get published and funded

## Three principles of peer review

- Fairness – provide an objective and impartial review
- Confidentiality – do not use ideas from the manuscript until it is published
- Speed – complete the review within a reasonable amount of time



# Conflict of Interest

- Conflicts of interest include:
  - *Possibility of financial gain from research*
  - *Competing work commitments that may affect an investigator's attention to a research project*
- Conflicts of interest may lead to bias in the planning, conduct, or reporting of research
- Conflicts of interest are not inherently bad
- Disclosure helps everyone be aware of and manage conflicts of interest

# Mentor/Trainee Responsibilities

- Mentors should establish clear expectations for trainees with respect to all aspects of planning, conducting, and reporting research
- Collegiality and learning are enhanced when mentors and trainees understand each other's interests and responsibilities
- Concerns about mentoring include finding mentors, conflicts between mentors and trainees, amorous or sexual relationships, "toxic mentors", networking, and equal opportunity for all trainees

# Collaborative Science



- Research team members – courtesy, respect, managing roles and relationships
- University – interdisciplinary collaborations
- Scientific community – sharing research data and findings
- Public partners – study relevant questions, share results

## Civility issues in research environments, including but not limited to, harassment, bullying, and inappropriate behavior

- Treat others in the workplace with respect
- Be aware of community standards of conduct
- Say something if you or a peer are experiencing inappropriate behavior

<https://www.vanderbilt.edu/compliance/includes/StandardsofConductSeptember2019.pdf>

# Protection of Human Subjects

Three principles describe the protection of human subjects in research

- Respect for persons
  - *Participation must be voluntary*
  - *Special consideration and protection is extended to “vulnerable” subjects*
- Beneficence – No person shall be placed at risk unless the risks are reasonable in relation to the anticipated benefits
- Justice – Risks and benefits should be justly distributed

<https://www.hhs.gov/ohrp/regulations-and-policy/belmont-report/index.html>

# Animal Research

- Animal-related activities are an integral part of teaching, research and outreach missions and help us advance the quality of life for people and animals
- Researchers should understand the roles and responsibilities of the scientist, attending veterinarian, Institutional Animal Care and Use Committee (IACUC), and administration
- If you expect to use or study living animals in your activities, talk with your research mentor about training that is required

# How often do problematic behaviors occur?

**Table 1 | Percentage of scientists who say that they engaged in the behaviour listed within the previous three years (n = 3,247)**

<b>Top ten behaviours</b>	<b>All</b>	<b>Mid-career</b>	<b>Early-career</b>
1. Falsifying or 'cooking' research data	0.3	0.2	0.5
2. Ignoring major aspects of human-subject requirements	0.3	0.3	0.4
3. Not properly disclosing involvement in firms whose products are based on one's own research	0.3	0.4	0.3
4. Relationships with students, research subjects or clients that may be interpreted as questionable	1.4	1.3	1.4
5. Using another's ideas without obtaining permission or giving due credit	1.4	1.7	1.0
6. Unauthorized use of confidential information in connection with one's own research	1.7	2.4	0.8 ***
7. Failing to present data that contradict one's own previous research	6.0	6.5	5.3
8. Circumventing certain minor aspects of human-subject requirements	7.6	9.0	6.0 **
9. Overlooking others' use of flawed data or questionable interpretation of data	12.5	12.2	12.8
10. Changing the design, methodology or results of a study in response to pressure from a funding source	15.5	20.6	9.5 ***
<b>Other behaviours</b>			
11. Publishing the same data or results in two or more publications	4.7	5.9	3.4 **
12. Inappropriately assigning authorship credit	10.0	12.3	7.4 ***
13. Withholding details of methodology or results in papers or proposals	10.8	12.4	8.9 **
14. Using inadequate or inappropriate research designs	13.5	14.6	12.2
15. Dropping observations or data points from analyses based on a gut feeling that they were inaccurate	15.3	14.3	16.5
16. Inadequate record keeping related to research projects	27.5	27.7	27.3

Note: significance of  $\chi^2$  tests of differences between mid- and early-career scientists are noted by \*\* ( $P < 0.01$ ) and \*\*\* ( $P < 0.001$ ).

**Taking a closer  
look:  
Research  
Misconduct**



# What is Research Misconduct?

- Fabrication
- Falsification
- Plagiarism

## *What is Research Misconduct?*

# Fabrication

- “Fabrication” is making up data or results and recording or reporting them.
- Examples include: Recording data for non-existent research subjects, reporting results for experiments that were not done.
- NOTE - Even just writing down bogus data (e.g., in a lab notebook) is considered RM. The bad data do not have to be published or released in any way for it to be a problem.

# *What is Research Misconduct?*

## Falsification

- “Falsification” is manipulating research materials, equipment, or processes, or changing or omitting data or results such that the research is not accurately represented in the research record.
  
- Examples include:
  - *The reuse of an image as representing different experimental conditions,*
  - *image manipulation (splicing, cropping, obscuring, enhancing),*
  - *changing data results for a better “fit”, etc...*

## *Some examples*

- This is a great article – I recommend reading it and some of the other linked articles

<https://www.nature.com/articles/d41586-020-01363-z>

## *Key points:*

- Be informed when working with data images
- Ask for assistance if unsure
- Always keep original scan/picture
- Be careful when changing file size/resolution, manipulating brightness/contrast, clipping images

## Let's discuss....

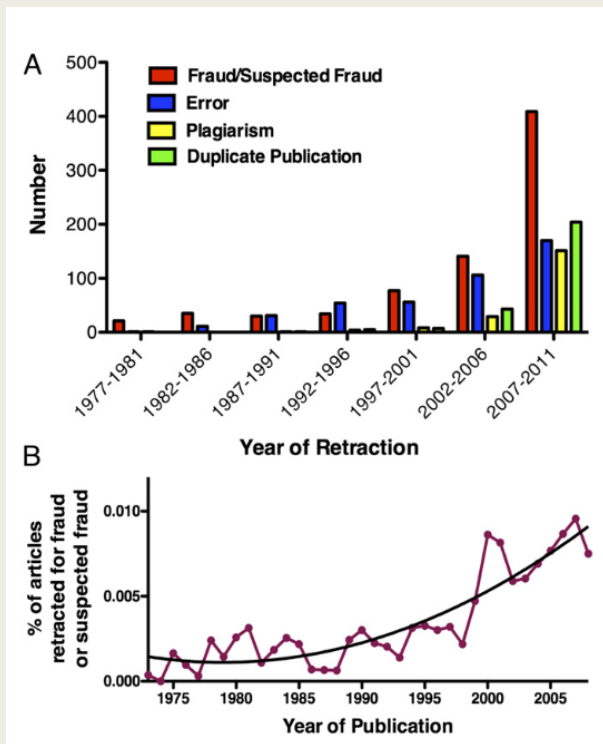
Is it ever OK to show the same data twice in a presentation/paper? For example, could you show a set of control measurements for comparison in more than one panel? Why or why not?

# *What is Research Misconduct?*

## Plagiarism

- “Plagiarism” is the appropriation of the ideas, processes, results, or works of another person, without giving appropriate credit.
- Examples include:
  - *Cutting and pasting whole sections of text from another source without using quotation marks AND clearly indicating its origin.*
  - *Pulling images from the web or other sources without attribution.*
  - *Self-plagiarism is also prohibited (but can be a grey area)*

# Research misconduct represents a low percentage, but...



Citations	Lead author	Publication–retraction	Title (retraction notice)	Journal
740	Wakefield, A.J.	1998–2010	<i>Ileal-Lymphoid-Nodular Hyperplasia, Non-Specific Colitis, and Pervasive Developmental Disorder in Children</i> (See vol 375, pg 445, 2010)	<i>The Lancet</i>
727	Reyes, M.	2001–2009	<i>Purification and Ex Vivo Expansion of Postnatal Human Marrow Mesodermal Progenitor Cells</i> (See vol. 113, pg. 2370, 2009)	<i>Blood</i>
659	Fukuhara, A.	2005–2007	<i>Visfatin: A Protein Secreted by Visceral Fat That Mimics the Effects of Insulin</i> (See vol 318, pg 565, 2007)	<i>Science</i>
618	Nakao, N.	2003–2009	<i>Combination Treatment of Angiotensin-II Receptor Blocker and Angiotensin-Converting-Enzyme Inhibitor in Non-Diabetic Renal Disease (COOPERATE): A Randomised Controlled Trial</i> (See vol. 374, pg. 1226, 2009)	<i>The Lancet</i>
512	Chang, G.	2001–2006	<i>Structure of MsbA From E-coli: A Homolog of the Multidrug Resistance ATP Binding Cassette (ABC) Transporters</i> (See vol 314, pg 1875, 2006)	<i>Science</i>
492	Kugler, A.	2000–2003	<i>Regression of Human Metastatic Renal Cell Carcinoma After Vaccination With Tumor Cell-Dendritic Cell Hybrids</i> (See vol. 9, p. 1221, 2003)	<i>Nature Medicine</i>
433	Rubio, D.	2005–2010	<i>Spontaneous Human Adult Stem Cell Transformation</i> (See vol. 70, pg. 6682, 2010)	<i>Cancer Research</i>
391	Gowen, L.C.	1998–2003	<i>BRCA1 Required for Transcription-Coupled Repair of Oxidative DNA Damage</i> (See vol 300, pg 1657, June 13 2003)	<i>Science</i>
375	Hwang, W.S.	2004–2006	<i>Evidence of a Pluripotent Human Embryonic Stem Cell Line Derived From a Cloned Blastocyst</i> (See vol 311, pg 335, 2006)	<i>Science</i>
366	Makarova, T.L.	2001–2006	<i>Magnetic Carbon</i> (See vol 440, pg 707, 2006)	<i>Nature</i>

Fang et al. Proc Natl Acad Sci (2012) Vol 109 p17028-33

...consequences could be catastrophic



# Estimated grant funding associated with retracted articles

Between 1992 and 2012, **291** articles published in the US were retracted for research misconduct.

The estimated funding totals of all NIH grants that contributed in any way to the retracted papers:

**\$2,324,906,182**

Stern AM et al. Elife. 2014 Aug 14;3

**What should you be  
thinking about  
now?**

# Be informed!

- Use papers you read as an opportunity to discuss and think about good practices (check out the supplementary or extended data)
- Read about best practices (Rigor and Reproducibility)
- Take a course in biostatistics/experimental design
- Learn about ways to present data that maximize transparency
- Ask questions!! Why? How? When?

<http://jbcresources.asbmb.org/collecting-and-presenting-data>

# Give (and take) credit appropriately

- Don't use "we" when you really mean "the lab"
- Even better, use the names of the people who did the work
- When you DID do the work, use "I" or "Dr. Smith and I"
- Ask about authorship if you are uncertain (who should be included?)
- If presenting the work you did (for example, an abstract or poster presentation at your home institution), include appropriate authors and get permission from all of them BEFORE submission
- The PI of the lab should always be included at the end of the author list; the person who trained/helped you should likely be included

# Admit if you don't know something or made a mistake

- You aren't expected to be perfect and we all make mistakes!!
- Admitting uncertainty or getting help is critical, especially when working with hazardous and/or expensive equipment/reagents or organisms
- Take good notes while being shown how to do something
- Pay attention to details and ask if something seems wrong or broken
- Make sure you understand what you are and aren't allowed to do without supervision

# Be a good lab citizen

- Keep your own work area clean – respect the work areas of others
- Don't "borrow" anything you have not been explicitly given permission to use
- Pay attention to what is going on around you
- Clean up after yourself in common areas – ask if you don't know what is expected or how to clean or dispose of something
- Respect the needs of others to concentrate – ask respectfully before interrupting, playing music, etc.
- Tell someone or follow instructions you are given for reporting supplies/reagents that are low or if you take the last one
- If you have a lab "job," complete it on time and with care
- Ask for help if you are unsure (BUT, as you get more experienced, spend some time trying to figure it out yourself)!

# Ask about data recording practices

- In notebooks or electronic (or both)?
- How much detail is required/expected?
- Ask to see examples
- Ask your lab mentor to check your notes and give you feedback
- Ask about practices for electronic data, including back-up
- Record why you did something and not just what you did
- Make sure someone else could figure out what you are doing
- Keep your notes up-to-date (every day!)
- The lab notebook belongs to the lab, not to you

# What information should I record?

Webinar with practical information and examples (~13 minutes)

<https://www.training.nih.gov/oite-yt/keepingalaboratorynotebook>



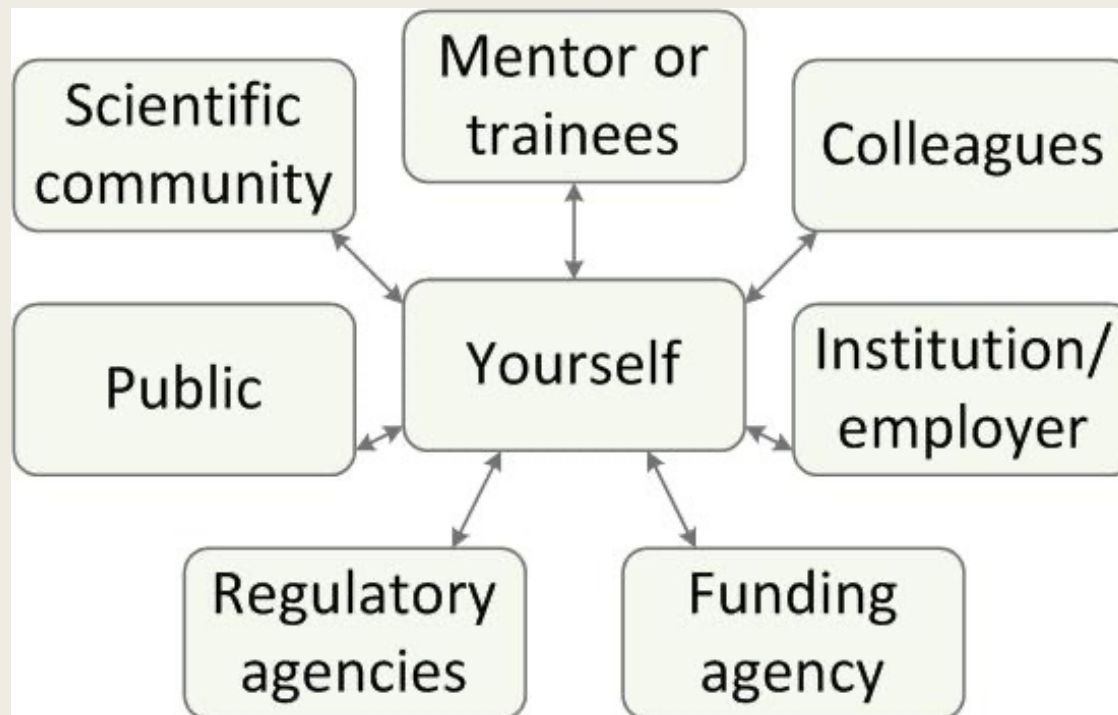
## Let's discuss....

What is the difference between a biological replicate and a technical replicate? Try to come up with an example and indicate why each type of replication is important. How does thinking about these differences affect how you might think about recording your data?

# Let's discuss....

Your poster needs to be ready for the printer tomorrow. You have completed your three control assays and the results are quite reproducible. Last week, you completed two replicates of your experimental sample and the results looked very different from the control. You excitedly reported to your mentor that there seems to be a clear and interesting effect on the phenotype. You finish counting the third experimental sample and find that the result is very similar to what you've seen in the control. What should you do?

Instead of responsible *for what*,  
think about responsible *to whom*



Learn, question, read, explore, and HAVE FUN!

## For more information

- *MSU Research Integrity Website*,  
<https://grad.msu.edu/researchintegrity/resources>
- *On Being a Scientist: A Guide to Responsible Conduct in Research*,  
3rd edition, 2009, page ix,  
[http://www.nap.edu/catalog.php?record\\_id=12192#toc](http://www.nap.edu/catalog.php?record_id=12192#toc)
- Steneck, N. *ORI Introduction to the Responsible Conduct of Research*,  
<https://ori.hhs.gov/ori-introduction-responsible-conduct-research>
- *Guidelines for Responsible Data Management in Scientific Research*, Office of Research Integrity  
<https://ori.hhs.gov/images/ddblock/data.pdf>

Interactive video where you can explore RCR issues from the perspective of different people: <https://ori.hhs.gov/the-lab>

# Slides modified from

- Michigan State University Graduate School
  - *Responsible Conduct of Research, Scholarship, and Creative Activities, 2010*
  - *<http://grad.msu.edu/>*
- Grand Valley State University
  - *Responsible Conduct in Research Workshop*
  - *February 24, 2018*
- Ohio State University
  - *Academic Publishing and the Responsible Conduct of Research*
  - *Melanie Schlosser - University Libraries*
  - *Jen Yucel - Office of Research Compliance*