

Responsible Conduct of Research

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What is the Criteria for Irresponsible Conduct of Research?

- Represents a significant departure from accepted practices
- Has been committed **intentionally**, or knowingly, or recklessly
- Can be proven by a preponderance of evidence



Why Worry About Responsible Conduct of Research?

- 1. Required**
- 2. Know Your Options**
- 3. Allow Science and Society to Function**



1. Required

- University Requirements
 - Required of all research graduate students at MSU
 - Required of all biochemistry postdocs and technicians by department
- Graduate students required to complete 6 hours of training by end of spring semester of their second year
- Three hours of training every year after that
- Biochemistry requires 5 hours of initial training and three hours after that for graduate students, postdocs, and technicians



1. Required

2007 USA COMPETES ACT

- National Science Foundation (NSF)
 - All undergraduate, graduate students, and postdocs supported on grants must be provided with training
 - Institution responsible for content, method of delivery, and frequency of training

SEC. 7009. RESPONSIBLE CONDUCT OF RESEARCH. *The Director shall require that each institution that applies for financial assistance from the Foundation for science and engineering research or education describe in its grant proposal a plan to provide appropriate training and oversight in the responsible and ethical conduct of research to undergraduate students, graduate students, and postdoctoral researchers participating in the proposed research project.*



1. Required

- National Institutes of Health (NIH)
 - Training grant awardees (K and T awards), individual or institutional grants
 - Must include face-to-face discussions plus other modes of delivery
 - At least 8 contact hours required
- USDA (National Institute of Food and Agriculture (NIFA))
 - Training required for all program directors, faculty, postdocs, graduate, and undergraduate students
 - Institution responsible for content, method of delivery, and frequency of training
- Department of Energy (DOE)
 - No specific RCR training requirement yet, but it's coming
 - *A recipient is responsible for maintaining the integrity of research of any kind under an award from DOE including the prevention, detection, and remediation of research misconduct, and the conduct of inquiries.*



3. Allow Science and Society to Function

- “Business is built on trust” and science doubly so
 - There is a literal and figurative cost if that trust is lost
- The anti-vaccine epidemic began with a 1998 fraudulent paper by Mr. Wakefield
 - It was a scheme to profit by selling IP for his own measles vaccine
 - This scientific misconduct has cost lives and untold amounts of money
- In a world of climate change denial and anti-GMO’s can we afford a loss of credibility in the scientific process?
 - According to a 2019 Pew research pole 86% of Americans say they have a great deal or fair amount of confidence in scientists to act in the best interest of the public.
 - This is compared to 77% K-12 principles, 46% business leaders, and 35% elected officials.



Three Cases in Which Scientific Misconduct Can Occur

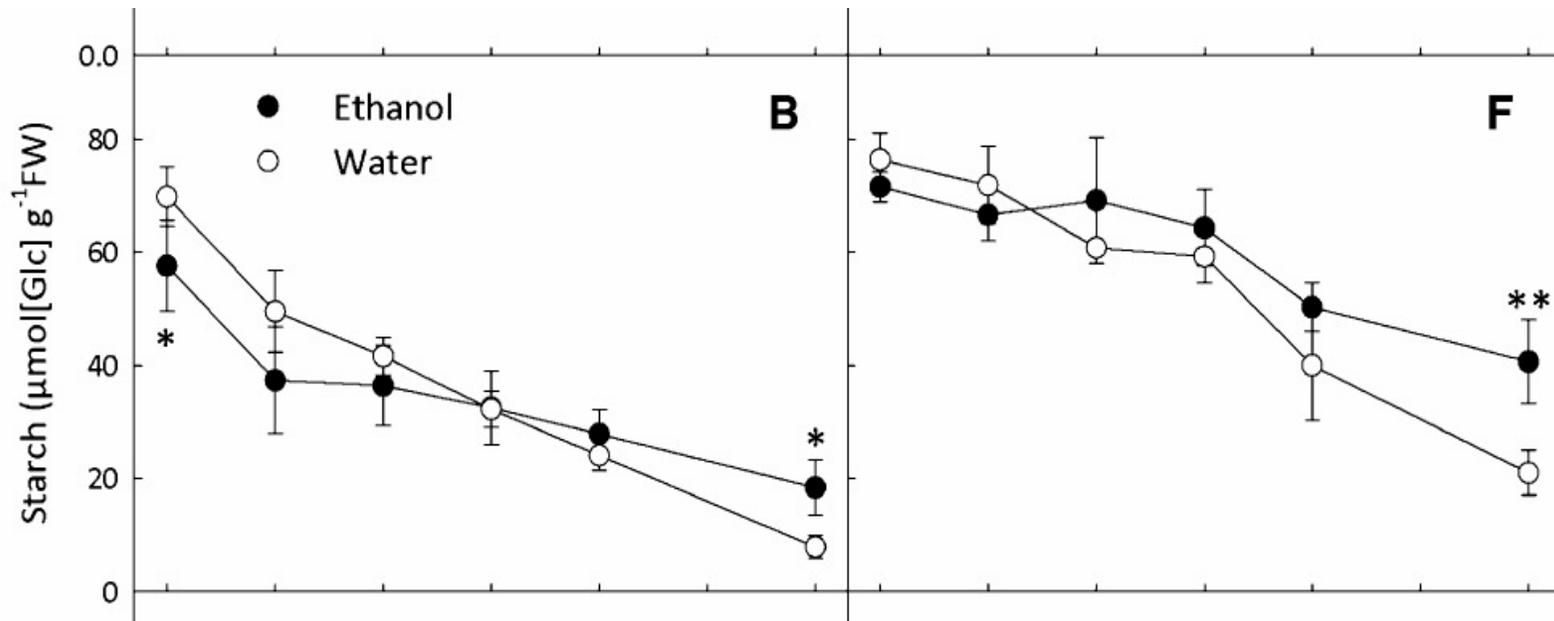
1. Falsification or Fabrication of Data
2. Authorship
3. Ownership of Intellectual Property (IP) and Physical Property



1. Cooking the Books – What we first think RCR means

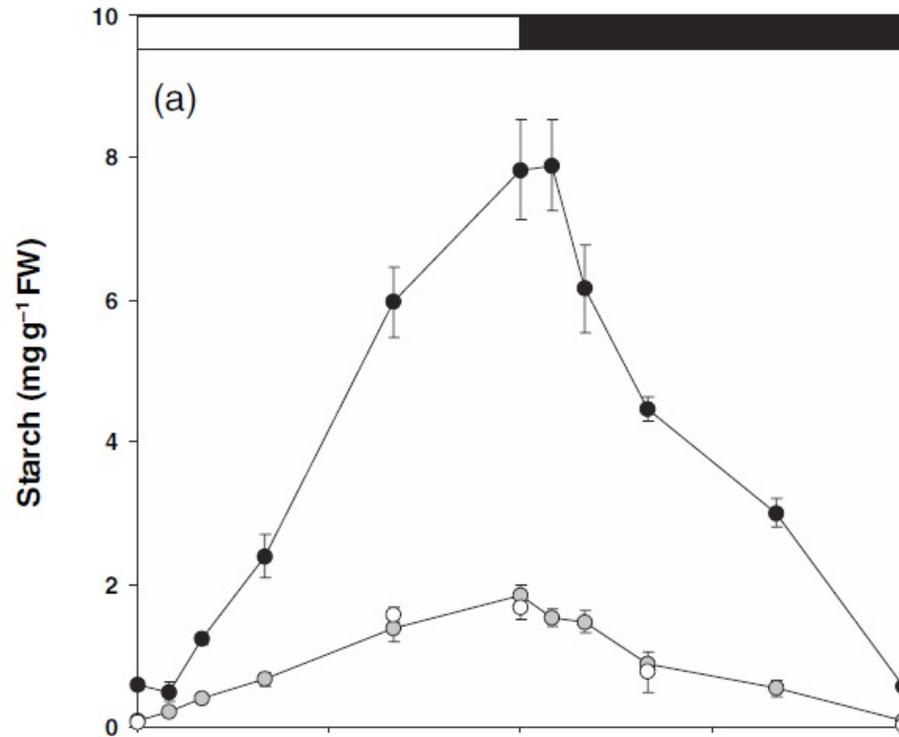
- **Fabrication** – Making up the results and recording or reporting them.
- **Falsification** – Manipulation of research materials, equipment, or processes, or changing or omitting results such that the research is not accurately represented in the record.
- **Plagiarism** – The appropriation of another's ideas, processes, results, or words without giving proper credit.





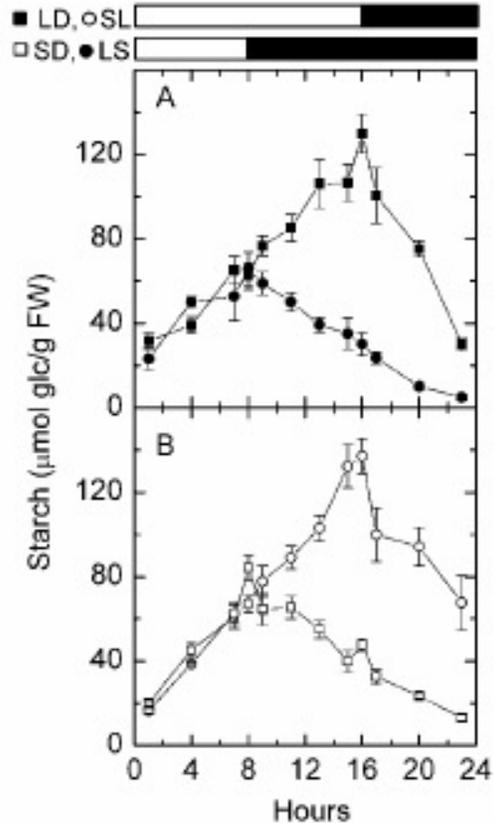
Martins MCM, Hejazi M, Fettke J, Steup M, Feil R, Krause U, Arrivault S, Vosloh D, Figueroa CM, Ivakov A, Yadav UP, Piques M, Metzner D, Stitt M, Lunn JE (2013) Feedback inhibition of starch degradation in *Arabidopsis* leaves mediated by trehalose 6-phosphate. *Plant Physiol.* 163: 1142-1163

Figure 3. Inhibition of starch degradation at night by induced high levels of Tre6P. Ethanol-inducible TPS29.2 plants were grown in soil with a 12-h photoperiod. Four-week-old plants were sprayed with water (white circles) or 2% (v/v) ethanol (black circles) at the ED (A–D) or in the middle of the day (E–H). Pools of five rosettes were harvested at the ED and at 2- or 4-h intervals through the night for the determination of starch (B and F). Data are means \pm SD ($n = 3$).



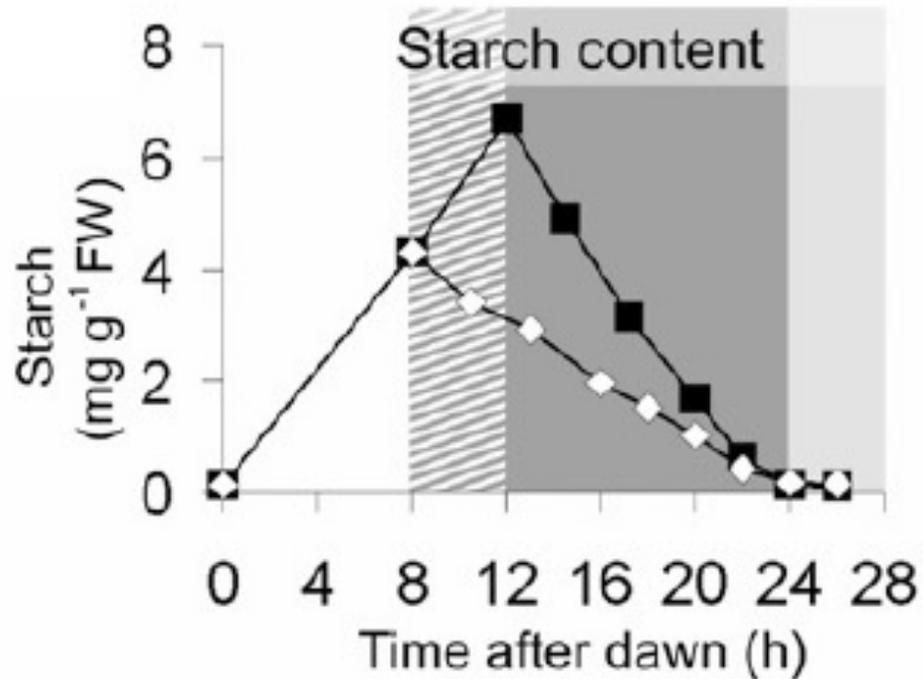
Delatte T, Trevisan M, Parker ML, Zeeman SC (2005) Arabidopsis mutants Atisa1 and Atisa2 have identical phenotypes and lack the same multimeric isoamylase, which influences the branch point distribution of amylopectin during starch synthesis. *Plant J.* 41: 815-830

Figure 6. Starch and soluble glucan contents of wild-type, Atisa1-1 and Atisa2-1 plants. All the leaves of individual wild-type (black symbols), Atisa-1 (grey symbols) and Atisa2-1 (white symbols, no line). (a) Starch was extracted using perchloric acid and measured as described in Experimental procedures. Each point is the mean \pm standard error from six replicate samples.



Lu Y, Gehan JP, Sharkey TD (2005) Daylength and circadian effects on starch degradation and maltose metabolism. *Plant Physiol.* 138: 2280-2291

Figure 1. Diurnal changes of starch in LD, LS, SD, and SL. A, LD (black squares) and LS (black circles). B, SD (white squares) and SL (white circles). White bars and black bars on the top indicate days and nights, respectively. Values are mean \pm SE ($n = 5$).



- A new graduate student presents this graph at lab meeting.
- Looks great, supports PI's hypothesis and is consistent with the Sharkey 2005 paper.
- Something is wrong.
- Where are the error bars?

- You are a graduate student in the lab with data that is going to be part of this paper. You hope to be a co-author. What do you do?

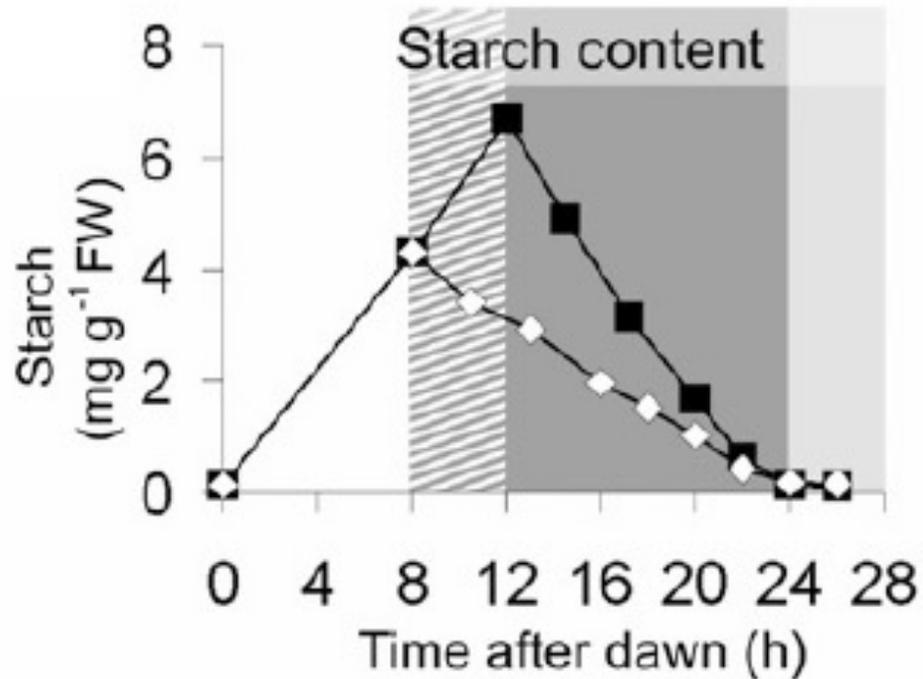


Fig. 1. Starch degradation is adjusted to unexpected changes in the length of the light period. Error bars (SEM) were smaller than symbols for all data points ($n = 6-8$ individual rosettes).

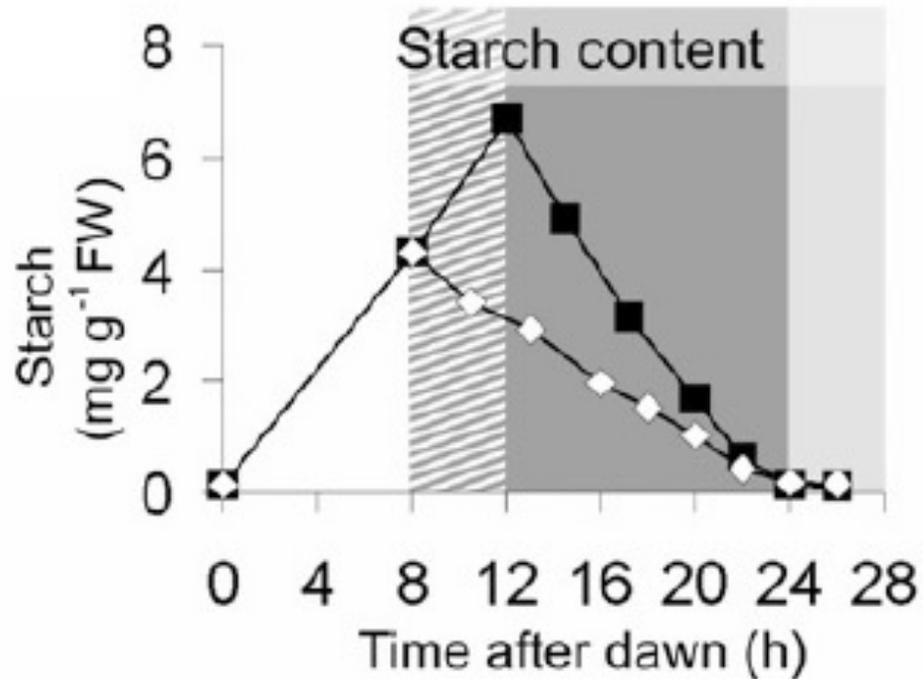
1. Talk to graduate student

2. Talk to PI

“Boy he is good, almost magic hands in the lab. This is going to be some paper!”

Was the PI willing to look at graduate student’s lab notebook and raw data and share this with you?

3. WTF!!??? NOW WHAT???



- It may be time to move on
- The academic mentor/mentee relationship is a close one and the power differential is huge.
“Your boss’s enemies become your enemies”
Bethany Haupt
- You need trust to do science and trust to build a scientific relationship
- You don’t want to be around when and if the “data” hits the fan.

2. Authorship

MSU Authorship Guidelines

- A person claiming authorship or being designated as an author of a creative endeavor should meet all of the following criteria
 - Participation in conception and design of the creative work, study, analysis, or interpretation of any data.
 - Participation in the drafting of the creative work or manuscript, or in the editing of the creative work or manuscript
 - Final approval of the version of the creative work or manuscript to be published
 - Ability to explain and defend appropriate portions of the work or study in public or scholarly settings.

2. Authorship – How am I not on that paper?

The left out Author

- <https://ori.hhs.gov/left-out-author>
- What would you do?
- Is it too late? No, Journals will print corrections called a corrigendum
- Talk to PI?
- Talk to lead or corresponding author?
- Work up the chain of command, perhaps the RIO?
- What if anything was agreed on before hand



AUTHORSHIP PRACTICES TO AVOID CONFLICTS

Every field of study experiences conflicts with determining authorship on published papers



ACKNOWLEDGEMENTS
Those who assisted¹ with a manuscript but did not provide substantial contributions can be given acknowledgement.

Implementing the following suggestions may help avoid potential authorship disputes:

BE PREPARED

Establish written authorship agreements with all members of the lab and other collaborators before preparing a manuscript or before starting a project.

DOCUMENT CONTRIBUTIONS

Authors should list their substantial contributions to the design of the study; the acquisition, analysis, or interpretation of data; and the contribution to the writing of the final paper.

BE CONSISTENT

Have clearly written expectations for authorship on publications and follow them.

COMMUNICATE OFTEN

As the project progresses, the authorship agreement may need to be revisited.

APPROVE THE MANUSCRIPT

All authors should review manuscripts and approve the final version.

¹This may include people who provide support such as: editorial assistance (e.g., proofreading), limited data collection, supervision of research tasks without contribution to the collection, analysis, or interpretation of data, or the writing of the publication, and technical support

- Be Prepared, Don't be Afraid to Ask
- Document Contributions
- Be Consistent
- Communicate Often
- Approve the Manuscript

Why would you leave someone out?

- More authors on a paper is a mark of leadership
- It shows you have ideas that others are willing to work for
- It shows you can collaborate with multiple researchers and pull the data together into one coherent story
- It generates good will and sense a team.



Submission of Original Work

- For the submission of papers, most journals require that the work not be submitted simultaneously elsewhere for consideration.
- Submission of a paper is tantamount to provisionally giving the selected journal copyright to the work, and it initiates considerable expense of time and effort in reviewing the manuscript.
- Only when an article has been rejected by or withdrawn from consideration in one journal may it be submitted elsewhere.



Avoid Duplicative Publication

- Publication of data in more than one location gives the findings more visibility, but it may also mislead readers.
- In clinical findings, this could give a false impression of the number of patients actually studied
- In basic research, readers might mistakenly conclude that the study had been replicated.
- Any data set, either in whole or in part, should not be published twice without making explicitly clear which of the data have been published previously and where and when the work was published.
- You don't own the copyright, the journal does, **you can plagiarize yourself.**



Identifying authors holds individuals accountable for the study's integrity and the publication's accuracy

- When authors publish an article, they declare that they have:
 - ✓ Participated in the writing or editing of the manuscript
 - ✓ Contributed intellectually to the content of the manuscript (*e.g.*, by providing the hypothesis, designing the study, and or analyzing the results)
 - ✓ Reviewed and approved the final version of the manuscript

2. Intellectual Property (IP) and Physical Property

Work For Hire

- Statutorily defined term from US copyright law. It is a work subject to copyright that is created by an employee as part of their job. The employer, not the employee, is considered the legal author.
- MSU generally follows the standard academic practice of disclaiming ownership of traditional academic works.
- This is good for scientists because the journals want the copyright.

2. Intellectual Property (IP) and Physical Property

Work For Hire

- Michigan State University owns all IP and physical property that we generate as part of our work MSU

*All discoveries or inventions by a University employee which: (i) result from research which is supported by University funds or by funds controlled or administered by the University; or (ii) were created in a field of work or study directly related to that employee's scholarly or other academic endeavors at the University; or (iii) have been developed in whole or in part through the use of University resources or facilities, **shall belong to the University** (hereinafter "University Inventions").*

Do you have to give your IP to others?

- You're a postdoc and you and your PI write a grant proposing new functions for two genes A and B.
- The grant is funded horary, everyone agrees you're a genius! (at least for today)
- You clone gene A and B with no trouble and put them in the most awesome expression vector ever that you secured an MTA for and everyone agrees is better than sliced bread and might even get you Nobel Prize.
- You plan to over express both genes and so you start on gene A.
- In the meantime a new naïve upstart grad student joins your lab. They don't know a plasmid from a manhole cover.
- At lab meeting your PI and this new grad student are discussing plans for YOUR gene B!!
- An hour later the grad student shows up at your desk and says "If you could just show me where the glycerol stock of with gene B is I can get started" You swear you hear them cackle "The Nobel will be mine....."

What Do You Do?



Do you have to give your IP to others?

- Discuss it with the PI

“Your moving pretty slow with gene A, We need papers to keep our funding.....Fork it over”

- Discuss it with the Grad Student

“I Don't think I will need any help, my undergrad thesis was on the best Jello mold to use at Christmas.”

- Discuss it with both
- Get it in writing. An email to clarify a conversation works well.
- Fork it over! In the end it's not yours and the PI is responsible for the lab.



2. Intellectual Property (IP) and Physical Property

It's Not MY Grant

- All federal grants and most non federal grants are made to institutions not individuals.

The rules for all Federal awards- including uniform administrative requirements, cost principles, and audit requirements anticipate that an institution/organization carries out a Federal award as the “recipient” of the award. The institution designates individuals, including an “authorized organization representative” (AOR) the program director/principal investigator (PD/PI), to assume the responsibilities described below, in fulfilling the terms and conditions of their award. The NIH Grants Policy Statement (NIH GPS), which is a term and condition of all NIH awards, summarizes these responsibilities and the respective roles of the institutions and individuals.

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