

Do the Right Thing – Theatrical Performance for Teaching Responsible Conduct in Research

Kuei-Chiu Chen¹ and Laurel L. Hester²

¹Weill Cornell Medical College in Qatar, Suite 432, Olin Hall, 445 E. 69th St., New York NY 10021 USA

²Keuka College, Division of Natural Sciences, Mathematics, and Physical Education, Keuka Park NY 14478 USA

kuc2005@qatar-med.cornell.edu; lhester@keuka.edu

As teaching students to conduct authentic science becomes one of the major foci in biology education, there is a need for institutions to prepare students for conducting science responsibly. In this mini workshop we use four separate fictional or true stories to cover some of the most common violations of ethical behavior in science. The instructor introduces the background and characters involved in each story. The characters then start their dialogue that often leads to a dilemma. The instructor then presents questions and conducts a poll using student response system (i.e. “clicker”). A short discussion follows with students expressing their comments on the story. The instructor then concludes by describing the common professional practice for the specific situations in the play. The plays require little training of the actors, which could be played by other instructors, teaching assistants or volunteer students, and may be performed in a lecture hall setting or in a lab.

Keywords: bioethics, research ethics, scientific integrity, responsible conduct

Introduction

The purpose of this presentation is to teach science majors the ethical practice of research. The presentation includes four separate case studies; all but one may be performed by faculty, teaching assistants or volunteer students to make the stories more lively and interesting. After presenting each case, the instructor asks the audience a multiple choice question, conducts a survey using the clicker, generates a discussion, and concludes by suggesting the most appropriate action.

Notes for the Instructor

To introduce students to ethical behavior in science, we used a few high-profile incidents of violation to set the stage. One of these incidents includes Hwang Woo-suk, whose fabrication of research data and unethical retrieval of human eggs led to the retraction of his two papers in *Science* (Hwang et al., 2004; Hwang et al., 2005) and the firing from his position at Seoul National University. Another example involves Terese Markow, who concluded in her papers on inbreeding of Havasupi Indian tribe based on blood samples intended for diabetes studies (Markow et al, 1993; Markow & Martin, 1993). As a contrast of unethical conduct, we also mention to students that researchers on H5N1 virus agreed on a moratorium on the research in order to evaluate the safety of the research. The moratorium was lifted after a year and the research resumed after it was determined to be safe.

Case One: Data Coding and Statistics

The first story, modified from Macrina (2005, p. 293), focuses on data coding and statistical testing. The story may be printed on a handout or may be presented on a slide.

Seth is a fifth-year Ph.D. student rerunning some analyses for manuscript submission. He is hoping that with the publication of this paper, he can secure a postdoctoral position at a reputable institution. Seth's research has involved analysis of survey data. He coded his data ranging from 1 = strongly disagree to 5 = strongly agree. To his surprise as he looks at the data book, he finds that there are a few trials where a "0" was recorded. He realizes that the 0's actually represent missing data. Instead of considering the data "missing," his initial analysis had included the 0's as real values, and the original submission was based on this erroneous analysis. In a slight panic, Seth deletes all of the 0s from the database and reruns the analysis. He breathes a sigh of relief because his results are still significant, but not highly significant ($p = 0.048$ compared to a previous reported $p = 0.009$). Seth is concerned that if he informs the publisher of this error, they would cast doubt on the integrity of his analyses and may cause delay or even rejection from publication. He decides that, since the results are still significant, he will erase all evidence of the previous 0s and only report " $p < 0.05$ ".

The instructor then asks the audience: Do you agree with what Seth does?

- Yes, he did not do anything wrong.
- No, his actions were unethical.
- Some of the things he did were ok, but some were not.

The instructor may indicate that the best choice is **B**. Although his results were still significant, Seth's action of erasing all evidence was not the acceptable practice. He could have sent a letter to the editor of the journal and explained the error and replaced the p value to 0.048.

Case Two: Modification of Gel Picture

The second story, adapted from Macrina (2005, p. 290) has two characters, Stewart Larson, an undergraduate student and his mentor, Professor Jennifer Laverty.

Narrator: *After two and a half years of hard work in a lab, an undergraduate student Stewart Larson has almost finished a paper to be submitted for publication. He is applying to an M.D.-Ph.D. program at a prestigious university and may receive a fellowship if he had publication. His Principle Investigator Jennifer Laverty is an assistant professor in her fourth year. While maintaining a small lab, Prof. Laverty wants to apply for tenure in a couple of years. A competing lab led by Dr. Park at another institute is larger and better funded.*

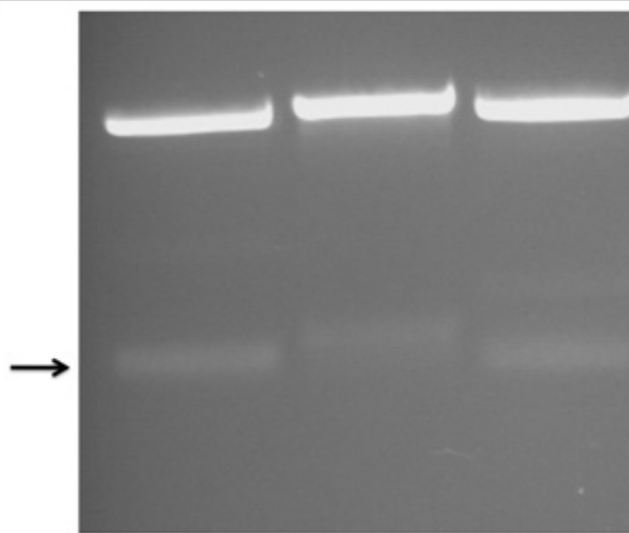
One of the experimental results in Stewart's paper is the picture of a gel. This gel has a few DNA bands, and when stained with ethidium bromide, the bands show up as predicted based on their sizes. However, he notices that there are extra bands that cannot be explained by his experiments alone. The following is a conversation between Stewart and Professor Laverty.

Prof. Laverty: Hi Stewart, are you ready for the end of the semester?

Stewart: Oh, yeah, very much, I can't believe that I actually miss my parents. I know I always miss my dog Shadow. But writing the paper for the last several months has got me a little homesick. I can't wait to go back home after the long semester, especially I'm almost done with the manuscript for submitting to *Nucleic Acid Research*.

Prof. Laverty: Oh right. Last week after the lab meeting, you mentioned there was something in the gel that you couldn't explain. I was rushing for a departmental meeting so I wasn't able to talk further. Can you show me the photo?

Stewart: Here it is. You see these extra bands.



Prof. Laverty: Gee... These are exciting discoveries. They could be... What are their sizes?

Stewart: About 3 kb.

Prof. Laverty: (Thinking...) If they are what I think they are, there's still quite a bit of work to do before we can confirm these bands. Are you almost done with your writing?

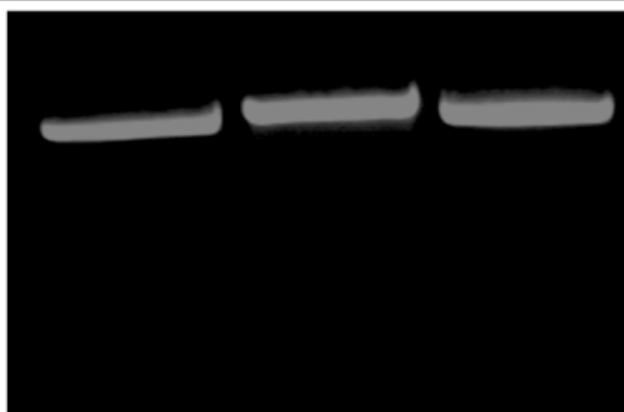
Stewart: Yes, I'm almost done, but I just don't know what to do with these extra bands.

Prof. Laverty: As exciting as these extra bands indicate, if we submit the paper out with this gel picture without further verifying them, the Park lab will scoop me. You know, they have a bigger lab and they are well funded. And I still need to get my tenure... Can you enhance the contrast of your photograph so that these extra bands disappear?

Stewart: But Professor Laverty, do you think it's a good idea? I know I can remove the extra bands quite easily, but is it what people do in the research world when it comes to things like this? I know I need a paper to increase my change of getting the fellowship to the MD-PhD program before next summer.

Prof. Laverty: That's why we should get this paper out first. What we can do is in the figure legend of this gel we say something like "minor signals of unexplained origin were present in this experiment but are not visible in the photograph". So we are telling the truth that the extra bands exist.

Narrator: Stewart followed Professor Laverty's suggestion and produced this photograph with the suggested figure legend. Their paper got accepted, and Stewart got in the MD-PhD program with the fellowship.



The following question is being asked of students after the narration.

Are Professor Laverty's and Stewart's actions appropriate?

- A. Yes, they were right to publish the modified image.
- B. No, they should have published the original image.
- C. No, they should have found another option.

The instructor may suggest that Answer **B or C** are more appropriate and point out that many publishers forbid the following:

- Splicing together different images to represent a single experiment
- Changing brightness and contrast of only a part of the image
- Showing only a small part of photo so other information is not visible
- Changing image to conceal faint signals

Case Three: Modification of Animal Protocol

The third case discusses vertebrate use protocol and is directly adapted from Bebeau *et al.* (1995, pp. 74-82) with minor changes. This case discusses modification of an existing protocol without the approval of IACUC. Characters in the case include Jenny, a second year graduate student, her roommate Ruth, and Jenny's research advisor Professor Chris Holzer. The case has about eleven dialogues and may be presented in 15 minutes, including the narration.

Characters:

Narrator, Jenny - a second-year graduate

Ruth - her roommate

Chris Holzer – professor and Jenny's advisor

Narrator: Jenny is overseeing an experiment Dr. Holtzer designed to determine whether a special anti-bacterial coating can reduce the incidence of infection associated with the use of steel surgical pins. With Holtzer's help, Jenny has inserted a pin into the right tibia of 30 rabbits; 15 of the pins are standard surgical pins, and 15 have the anti-bacterial coating. About 6.35 mm (1/4 inch) of each pin protrudes through the skin. All the rabbits were then inoculated at the insertion point with 10^8 *Staphylococcus aureus* and are given morphine to alleviate any discomfort. Jenny has cared for the rabbits for almost a month, recording observations and watching for any signs of distress or infection."

Jenny sees Dr. Holtzer in the lab...

Dr. Holtzer: Hi Jenny, how has your work been going?

Jenny: Oh, the rabbits seem fine – they don't seem to be uncomfortable or anything, but none of them are showing any signs of infection.

Dr. Holtzer: Hmm... if we don't get an infection, we won't learn anything about any differences between the two types of pins. It would be a shame to have put these rabbits through this, not to mention wasting all your time without getting some results. Here's what we'll do – I want you to help things along a bit... inoculate all the rabbits with 10^9 *Pseudomonas aeruginosa*. We'll see what happens then.

Jenny hesitates, then says: The protocol specifies *Staphylococcus*, Dr. Holzer.

Holtzer brushes this off and says: Well, it's only a small change. We've been approved to run the risk of infecting these rabbits; all we're going to do is give the process a little boost." ... and then Holtzer walks away.

Narrator: *Later Jenny talks with her roommate.*

Ruth: Hey Jenny, how's it going?

Jenny (groans): Oh, I saw Dr. Holzer today, and since none of the rabbits are getting infected, he wants me to inoculate them with *Pseudomonas* to try to get some results, but *Pseudomonas* can produce a nasty infection and is harder to treat. Also, the protocol specifies *Staphylococcus*. I don't know what to do.

Ruth: Geez, thank goodness I'm in English instead of biology. I'd hate working with animals period, much less having to make decisions like that.

Jenny: Yeah, I think animal experimentation is justified, but I just don't know about the change in protocol.

Ruth: Well, if your boss thinks it falls within the realm of reasonable interpretation of the protocol, shouldn't it be ok? I mean, you always planned on some of these rabbits developing infections. If you don't get results, you'll just have to yank out the pins and operate on a new bunch of bunnies.

The instructor then asks the audience, "What should Jenny do?"

- A. I agree with Ruth Thompson, experimenting on animals is unethical in the first place.
- B. I agree with Dr. Holzer, it would be best to modify the protocol to increase the likelihood of getting significant results and make the most of the experiment.
- C. Jenny should follow the original protocol because it has been approved by the animal research board.
- D. Jenny should follow the original plan because changing it in the middle of the experiment would unfairly bias the results.
- E. Other

The instructor may suggest that choices **C and D** are more appropriate (for different reasons). For choice **C**, students should be informed that all research conducted on vertebrate animals (including humans) requires prior approval by the appropriate committee of the institution where the research is conducted. Any modification of the protocol has to be approved by the committee before the modified research can be conducted. For choice **D**, it involves change in the experimental design and it is possible that some of the results may not be reliable due to the change.

Case Four: Plagiarism Sleuths

This case was created based on a true incident described in an article on *Science* (Couzin-Frankel & Grom, 2009). Four individuals are involved in this case: Skip Garner, a compu-

tational biologist and creator of **Déjà Vu**, a program that searches similarity between published articles. Beth Notzon is the administrative editor at International Journal of Radiation Oncology, Biology, Physics. She teaches classes on publication ethics to physicians at M.D. Anderson Cancer Center in Houston Texas. Odilia Popanda is the author of original paper in International Journal of Radiation Oncology, Biology, Physics (2003) and works at German Cancer Research Center. Wei-dong Wang is an oncologist at Xinqiao Hospital in Chongqing, China and author of a 2005 paper in Clinical Cancer Research that copied more than 95% of Odilia's paper.

Skip: I wanted to access the scientific literature more efficiently, so I made a computer program that made it easy to sort through a database's 19 million papers to pick out those on just one topic. I soon realized the same program could do stuff like find plagiarisms, so with support from the NIH, I refined the program to make Déjà Vu – an online database that is 'a study of scientific publication ethics' and lists more than 70,000 pairs of papers with striking similarities in language or content, leading to at least 48 retractions of suspicious papers – and some journals now run accepted papers through the software to check for duplications before publication.

Narrator:... *"but how reliable is Déjà Vu? Many papers flagged are innocent translations, reviews, or publications by the same author on similar research"*

Beth: Déjà Vu alerted our journal that a group in China had copied more than 95% of Odilia's 2003 paper on breast cancer. We contacted the other journal and the authors.

Wei-dong: Our English skill was not good enough to meet the language requirements of the journal we wanted to publish in – Clinical Cancer Research, so we copied Odilia's paper but substituted our own results on nasopharyngeal cancer.¹

Odilia: I felt used – I worked hard to write that paper, and English is not my native language either. Their paper was even published in a higher profile journal!

Clicker Question (What should Wei-dong do?)

- A. Nothing.
- B. Retract the paper.
- C. Keep the paper, but write his own papers in the future.
- D. Other

Wei-dong: We have done foolish things, we should express our findings in our own words"... "so we decided to withdraw the paper.¹

Beth: When I started teaching classes on publication ethics to our Cancer Center physicians, I was surprised that many foreign scholars, particularly those from Asia considered this type of 'patchwriting' perfectly appropriate. We had a young woman visiting from China who taught writing and editing

in China and she said that they encourage this sort of thing because people don't have good idiomatic English.²

Odilia: But I think this type of writing is wrong because it's really a kind of plagiarism – they're taking someone else's research idea!³

Skip: Sometimes our results lead to more questions than answers, but I think it is good for this topic to be discussed. Having the ability to compare papers pushes researchers to be more original in their writing and their research and helps journals avoid printing duplications of information that is already out there – whether it is by the same author or by a different one. And we've also revealed clear cases of misconduct where researchers have published copies of papers by other authors without even citing the original paper.

¹ Wei-dong quotes are taken directly from quotes attributed to an email message by him to Science for the Couzin-Frankel and Grom(2009) article.

²These Beth Notzon quotes are her quotes given in the Couzin-Frankel and Grom (2009) article.

³This Odilia quote is actually a quote from Beth Notzon in the Couzin-Frankel and Grom (2009) article.

Acknowledgments

Carl Hopkins inspired us to produce these skits on ethics in research. David Deitcher provided the two gel pictures to make the gel picture case more real. Numerous teaching assistants contributed to the skits by being the actors or narrators of the cases.

Literature Cited

- Researcher faked evidence of human cloning, Koreans report. 2006, January 10. *The New York Times*. Retrieved from http://www.nytimes.com/2006/01/10/science/10clone.html?pagewanted=1&ref=hwang_woo_suk
- Bebeau, M., K. Pipple, K.Muskavitch, S. Borden, and D Smith. 1995. The Jenny Ito case. Pages 74-82, in *Moral reasoning in scientific research: Cases for teaching and assessment*. Indiana University, Bloomington, Indiana, 83 pages.
- Couzin-Frankel, J. and J. Grom. 2009. Plagiarism sleuths. *Science* 324(5930): 1004-1007.

Hwang, W. S., S. I. Roh, B. C. Lee, S. K. Kang, D. K. Kwon, S. Kim, S.J. Kim, S. W. Park, H. S. Kwon, C.K. Lee, J.B. Lee, J.M. Kim, C Ahn, S. H. Paek, S. S Chang, J.J. Koo, H. S Yoon, J. H. Hwang, Y. Y. Hwang, Y. S. Park, S. K. Oh, H. S. Kim, J. H. Park, S. Y. Moon and Gerald Schatten. 2005. Patient-specific embryonic stem cells derived from human SCNT blastocysts. *Science* 308(5729): 1777-1783.

Hwang, W. S., Y. J.Ryu, J. H Park, E. S Park, E. G.Lee, J. M Koo, H. Y. Jeon, B.C. Lee, S. K. Kang, S. J. Kim, C. Ahn, J. H. Hwang, K. Y. Park, J. B. Cibelli, and S. Y. Moon. 2004. Evidence of a pluripotent human embryonic stem cell line derived from a cloned blastocyst. *Science* 303(5664): 1669-1974.

Macrina, F. L. 2005. Scientific record keeping. Pages 269-296, in *Scientific integrity: Text and cases in responsible conduct of research (3rd Edition)*.ASM Press, Washington, D.C., 428 pages.

Markow, T. A., P. W., Hedrick, K., Querlein, J. Martin, J. Danilovs, T. Vyvial, , and C. Armstrong. 1993. HLA polymorphism among the Havasupai of northern Arizona. *American Journal of Human Genetics* 53:943-952.

Markow, T. A., and J. Martin. 1993. Inbreeding and developmental stability in a small human population. *Annals of Human Biology* 20:389-394.

About the Authors

Kuei-Chiu Chen received her Ph.D. in biology from New York University. She was the lab coordinator for three introductory biology courses at UCLA. In 2005 she joined Cornell University as Director of Introductory Biology Laboratories, which was later changed to Investigative Biology Laboratory after a curricular reform. Currently she is Senior Lecturer of Biology and Director of Instructional Laboratories, Premedical Program at Weill Cornell Medical College in Qatar.

Laurel Hester received her Ph.D. in biology from the University of Michigan, Ann Arbor and has since taught biology labs at several places. She is currently an assistant professor in Keuka College's Division of Natural Sciences, Math and PE. Laurel enjoys living in upstate New York and loves working at a small college where she can teach many different courses and all of their lab sections.

Mission, Review Process & Disclaimer

The Association for Biology Laboratory Education (ABLE) was founded in 1979 to promote information exchange among university and college educators actively concerned with teaching biology in a laboratory setting. The focus of ABLE is to improve the undergraduate biology laboratory experience by promoting the development and dissemination of interesting, innovative, and reliable laboratory exercises. For more information about ABLE, please visit <http://www.ableweb.org/>.

Papers published in *Tested Studies for Laboratory Teaching: Peer-Reviewed Proceedings of the Conference of the Association for Biology Laboratory Education* are evaluated and selected by a committee prior to presentation at the conference, peer-reviewed by participants at the conference, and edited by members of the ABLE Editorial Board.

Citing This Article

Chen, K.C. and L.L. Hester. 2014. Do the Right Thing – Theatrical Performance for Teaching Responsible Conduct in Research. Pages 341-346 in *Tested Studies for Laboratory Teaching*, Volume 35 (K. McMahon, Editor). Proceedings of the 35th Conference of the Association for Biology Laboratory Education (ABLE), 477 pages.

<http://www.ableweb.org/volumes/vol-35/v35reprint.php?ch=25>

Compilation © 2014 by the Association for Biology Laboratory Education, ISBN 1-890444-17-0. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the copyright owner.

ABLE strongly encourages individuals to use the exercises in this proceedings volume in their teaching program. If this exercise is used solely at one's own institution with no intent for profit, it is excluded from the preceding copyright restriction, unless otherwise noted on the copyright notice of the individual chapter in this volume. Proper credit to this publication must be included in your laboratory outline for each use; a sample citation is given above.