

## PHYSICS

### Forensics & Race - Teaching Diversity in a Physics Lab (Phys-111: Our Universe: Forensics Lab)

*Gregory Braun, Ph.D.*

*Mentor: Ginger McKenzie, Ph.D. (Education)*

As the importance of diversity becomes more significant to the University's Jesuit mission, it becomes the responsibility of the faculty to address these issues in the classroom. Diversity is part of the Xavier University mission to "form our students intellectually, morally, and spiritually, with rigor and compassion, toward lives of solidarity, service, and success". Because physics attempts objectivity and detachment from society, this provides a challenge. But, the course Physics and Forensics offers a strong connection between science and society, and so is well-suited to adapting to teach social issues. I decided to look primarily at racial diversity, and hoped to show that the detachment from society provides science with an objectivity that serves to avoid the racial prejudices so common in our society. Through the process, I learned both what does and does not work well. While the overall student response was mediocre, I do believe that important issues were brought to the minds of the students. Within the limitations of the physics laboratory class, I am satisfied with the results of the project.

The course used was Phys 111, *Our Universe: Forensics Lab*, which we usually refer to as "Physics and Forensics". This is a core science class (the reason for the *Our Universe* denotation), taken by non-science majors to satisfy the sciences requirement. Many of the students choose this course because of some small interest in forensics, or at least in forensics-based television shows. Other students take the class only because it fits within their schedule. One criminal justice student has taken the course each of the last two semesters, but other than this the students have no dedication to the science of forensics. The course consists of lecture twice a week and lab once, with the lab broken into two sections. I taught both lab sections, and wanted to see what could be done to bring diversity issues to this part of the course.

The course teaches some of the methods used in forensics, but more importantly, teaches the science behind the methods. We want to show the students how scientists think and do things, rather than teaching them how to be forensic scientists. For our purposes, forensics is an example of an application of science. While the course topics include chemistry and biology in addition to physics, the focus is more on the nature of science itself, independent of any specific discipline. In the lab, we both practice these techniques and demonstrate the scientific processes that are involved. In some lab periods, we do not do anything that a forensic scientist would do, but instead deal with the phenomena that make the forensics possible.

The science of forensics is intrinsically linked to the criminal justice system, which has obvious racial issues. I wanted to look at how these racial issues affect how scientists must deal with certain techniques. When dealing with a population of unequal proportions, it is always important to be aware of how this will affect the science. For instance, while 12% of the U.S. population is black, they make up 41% of the prison population<sup>1</sup>. This tells us that

whatever the cause, we can expect similar disparities in those involved in criminal investigations. We must learn how to deal with these inequalities and provide the most accurate results. This concern with accuracy is not just moral, but also scientific.

While I wanted to deal with racial diversity, I did not want to detract from the science in the class. In particular, I did not want this to become an ethics of technology course and debate the general use of forensics technology in the justice system. Rather, I want to look at specific ways in which race affects how we do forensics. Science still needs to be the focus of the course. So, while we mentioned the disparate treatment of different races, this was not the focus. Instead we focused on the extra thought needed by forensic scientists to prevent forensic evidence from contributing to this disparity. To this end, I discussed three topics involving racial issues, with increasing objectivity and reliability.

I must say that for the remaining weeks of lab we did not mention race at all. Some topics, such as fingerprinting or glass fragment analysis simply have no racial issues. I should also mention that we did not discuss the racial differences in victims of crime, for the simple reason that forensic evidence tends to deal much more with the perpetrator than the victim.

### **Course Topics Related to Diversity**

The first lab dealing with diversity was the lab on eyewitness identification. Here we discussed two issues, the first being the differences in identification of people of different races. Race is one of the most distinguishing characteristics of a person, and the races are not equally represented in the population. Identification of an individual with any minority trait is different from that of a majority trait, whether the trait is race, height, or any other obvious physical descriptor. If an individual is described with a height of 6'8", this piece of information is of a different nature than that of someone 5'10". A person of extreme height is more easily identified, because fewer people are of that height; thus the height of this person carries more information than the height of a medium-sized person. The danger is that this one piece of information blinds us to other characteristics, if height is the only factor we consider. The same is true of race. If a suspect is identified as a black male in a predominately white population, then this fact eliminates a large number of people and so carries a good deal of information. If we use this to ignore other factors, however, then we run the high risk of identifying the wrong person. At the scientific level, we have to treat identification of a minority race, height, etc., as different from that of a majority trait.

This is an issue with any type of identification of any type of subject, but it becomes much more important when dealing with race. The fact is that the forensics techniques listed here may all discover the race of a suspect and nothing else. In a society that treats different races very differently, identifying a suspect by no more than their race can perpetuate stereotypes. In addition, this can lead to misidentification of innocent members of the same race. While any information is potentially useful to a scientist, this one piece of data can unfortunately strengthen the link in society's mind between race and crime.

The above effect is compounded by the fact that eyewitness identification is inherently subjective and unreliable. Whenever the judgment is being made by humans, personal prejudices are bound to interfere. And racial prejudices are some of the strongest, whatever those prejudices may be. We know that different races are not represented equally in the criminal justice system, whatever the cause. Finally, in addition to prejudices, any eyewitness

identification is simply unreliable<sup>2</sup>.

The other issue we dealt with in the eyewitness identification lab is that of the Own-Race Bias, also called the "other race effect". Many studies over the years have shown that witnesses are about one and a half times more likely to make a mistake when identifying individuals of races other than their own<sup>2</sup>. While there are multiple theories for the reason behind this, our concern is the fact that it happens. As scientists, we would give less weight to interracial identification than to that of the same race, since it has shown to be less reliable. As a society, we have to consider the ramifications of determining the value of testimony based on race.

The next lab dealing with racial diversity was one in which we observed some identifying properties of hair. Here the students looked at hair under a microscope and learned what can be done to match samples. Looking at strands of hair alone can tell us only a few things, one of which is possibly race. Again we are faced with race being possibly all we know of a suspect, and many of the problems with eyewitness identification return. Hair identification is also somewhat subjective, and so personal prejudices again may interfere with the science. While far better than eyewitness identification, hair analysis does depend on judgment calls by the analyst. Here we are dealing with the prejudices of the forensic scientist instead of a general witness, and we may have more confidence in the objectivity of the professional scientist. This is the middle step in the theme of progressing objectivity of techniques, being more objective than eyewitness testimony, but less so than DNA. Also, hair analysis is more reliable than eyewitnesses, but less so than DNA. The FBI used DNA to investigate the accuracy of hair analysis and found 11% of positive hair matches to be false<sup>3</sup>.

Finally, we did a lab involving DNA. The actual lab itself dealt with beads showing the structure of DNA, as well as the steps taken to analyze it. However, at the beginning of the class we discussed some of the properties of DNA analysis related to race. The first thing I mentioned is that DNA has shown us there is no difference between races at the genetic level; there is no gene for "race." This leads to that fact that DNA evidence is not subject to some of the problems that other forensic techniques are. DNA analysis is much less affected by personal prejudices than are eyewitness and hair analysis. DNA is thus more color-blind, and it is this objectivity we value in a science. Here was a great opportunity to show that good science is less prone to personal prejudice.

We talked about using DNA to exonerate wrongly convicted suspects by groups such as the Innocence Project<sup>4</sup>. The statistics for these exonerations show that the racial makeup of those exonerated in general mirrors that of the prison population, which does not indicate or contraindicate any specific racial bias in the accuracy of convictions. The exception to this is if we look only at rape offenders, in which a disproportionate number of those exonerated are black. The significance of DNA exoneration to us was that it shows the unreliability of other, more subjective techniques. It is of note that false eyewitness identification played a part in 74% of the cases where the convicted was ultimately exonerated by DNA evidence<sup>5</sup>.

Usually, a DNA sample from a crime scene is matched to a sample taken from an individual. If there is no individual with whom to compare, the race of the DNA samples source may still be determined. While DNA does not show definitive differences between races, it can show traits that are more common in one racial gene pool than another. These markers can give a probable match for race. This technique is prone to error, and is also controversial<sup>6</sup>, and all of

the earlier issues with knowing only a suspect's race remain problematic.

## **The Student Response**

Laboratory classes are structured with an initial explanation and by the instructor, followed by the students performing the experiment or activity in pairs. The instructor helps individual groups during the entire period, but most of the presentation of material is done in the introductory lecture, and this is where most of my discussion of diversity occurred. The downside of this is that the students know that they are free to go upon completion of the experiment and so are eager to get started. This always makes student participation in the introductory lecture very limited, which is usually not a problem since they are participating throughout the lab. Since the diversity issues were dealt with primarily at the beginning of the class, student participation was limited. In future semesters, I hope to change this and involve diversity material throughout the lab period.

A note of interest is that, at the beginning of the eyewitness identification lab period, I asked the students to list some of the traits used to visually identify someone. I found it interesting that in both sections race was one of the very last things mentioned, after height, weights, scars, tattoos, etc. I think this represents a reluctance to think about race at all. This reluctance to bring up the issue is one of the things that I wanted to overcome.

At the end of the semester, we do a mock crime scene, where students and faculty were suspects in a staged crime. It happened by chance that in one section one of the students was identified as a black female by an eyewitness. I was very pleased when students brought up some of the issues we discussed at the very beginning of the semester. Although there was only one black student in the suspect pool (the other lab section), the students were quick to point out that this identification really had limited value in the case. Their discussion let me know that at least the few students working on this part of the case understood very well exactly what I had wanted to express upon them and remembered it months later.

When analyzing hair samples for the mock crime scene, the students first looked at the hair, and then chose students from a "mug book" from which to acquire hair samples for comparison. Some of the hairs found at the scene of the mock crime were of a very dark color, which led the students to request hair from students with dark hair, including the few black and Hispanic students. We talked about the effects of selecting members of one race for further analysis, and whether or not this was good science. Since the issue was purely hair color, the students determined that race was not much of an issue here. Hopefully, they understood that part of the scientific process is determining whether any factor is relevant, race or otherwise.

Near the end of the course, the class was assigned a short research paper on a topic showing the intersection of forensics and society. They were to look at some aspect of forensics that affected, or was affected by, not only those involved in the case but society at large. This could consist of looking at one specific case, a forensic technique, or some trend in forensics as a whole. While I expected many students would choose some diversity issue, only a few did so. Many students misunderstood the project, and failed to deal with any significant societal issue. Those that did deal with society covered interesting topics, but not many were diversity related. This may be partially due to the fact that students thought they

needed to deal with something beyond what was done in the lab, and so they chose a topic other than diversity. Whatever the reason, I was disappointed that so few students did chose to further investigate diversity issues.

While the student response was less than I had expected, I am still glad that this material was introduced into the class. I do feel that the project was a success, and will continue to implement this material in the course. I hope that as I become more experienced in teaching this material, it may be better integrated into the lab experience as a whole, becoming a more central part of the labs in which it is involved.

When I started thinking about this project, I considered the possibility that this would be a candidate for the university's proposed diversity requirement. I have since reached the conclusion that this will not meet the requirements for such a course, at least as they are proposed now. The biggest issue is that there are only isolated topics which are relevant to diversity. The majority of the course (both lab and lecture) deal with scientific topics unrelated to diversity, and attempting to make diversity an underlying theme of the entire course would severely hinder the science. That being said, I think that the topics where race is a factor are very important, and need to be discussed. Whether or not Forensics fulfills a diversity requirement, I believe the university mission compels me to discuss these issues when they are relevant.

## References

1. Harrison, Paige M. and Beck, Allen J., Prisoners in 2005, Bureau of Justice Bulletin, <http://www.ojp.usdoj.gov/bjs/pubal/p2.htm#Prisoners>
2. Meissner, Christian A. and Brigham, John C., Thirty Years of Investigating the Own-Race Bias in Memory for Faces: A Meta-Analytic Review, *Psychology, Public Policy, and Law*, 2001, Vol. 7, No. 1, 3-35 10
3. Saferstein, Richard. *Criminalistics: An Introduction to Forensic Science*. (8th ed.) Pearson Education Inc., Upper Saddle River, New Jersey, 2004.
4. [www.innocenceproject.org](http://www.innocenceproject.org)
5. Rizer, Aurthur L., III, The Race Effect on Wrongful Convictions, *William Mitchel Law Review*, Vol. 29:3, 2003, p845-867.
6. Cho, M. and Sankar, P., *Nature Genetics Supplement*, Vol. 36, No. 11, November 2004.