Chapter 3.3: Ethics in Forensic Science

“He that would make his own liberty secure must guard even his enemy from oppression” Thomas Paine (1737 - 1809)

Learning Goals and Objectives

There is an inherent tension between scientific practice and legal requirements. In this section, you will need to understand the following concepts:

- What is meant by ethics and how can it guide decisions
- What are the possible conflicts encountered in the practice of forensic science;
- What is a “Code of Ethics”;

Scientists are supposed to be unbiased, detached observers who seek simply to understand the physical world through observation, experimentation and interpretation. They are not supposed to “take sides” by supporting any one particular hypothesis while performing experiments or analyzing the results. They are supposed to impartially evaluate the data, revise or abandon a hypothesis on the basis of the results, and then continue to explore the possibilities through new rounds of experimentation and analysis. Similarly, forensic scientists are expected to follow the evidence wherever it might lead them in an investigation without any preconceived or biased notions of the potential outcomes. All scientists are expected to conform their practices both to the standards of their professions and to the process of the scientific method. This, of course, includes experimentation and the concept of falsifiability – the possibility that an hypothesis can be shown to be false by a reproducible observation or experiment. In other words, the work of a forensic scientist must both seek evidence that an hypothesis is correct but also look to see if other explanations could be true and the original idea incorrect or incomplete. For example, a comparison of a suspect’s fingerprint with an unknown fingerprint must look not only for similarities between the two prints but also disclose any differences that might show that the two prints are not from a common source (the suspect’s fingers). Forensic science must, therefore, look towards experiments to show that an hypothesis is incorrect as much as to support the theory being tested.

Ethics is a part of philosophy that deals with questions that surround our understanding of right and wrong and helps us to decide in difficult cases which is the better pathway to follow. It does not provide answers, just guidance. In forensic science, ethics helps to keep our system of justice fair and accurate and to provide a framework for how science can operate to effectively and correctly to inform legal questions. It helps to protect both the rights of the individual and those of society fairly in areas of potential conflict – conflicts that often result in court cases. Much has been
written about ethics in science, and specifically in forensic science, such that now a reasonably deep foundation exists now for considering these issues. A full and necessary treatment of this vast area, however, is well beyond the scope possible here so selected issues will be simply presented.

A number of important organizations dealing with forensic science have established an agreed upon set of ethical and moral practices that help guide forensic experts and laboratories in their work. The American Academy of Forensic Science (AAFS), the largest professional organization for forensic science, has established a set of ethical guidelines to help promote the highest standards of practice in the field. Similar guidelines have been established by many other organizations dealing with various aspects of forensic science such as American Society of Crime Lab Directors (ASCLD), National Association of Medical Examiners (NAME), American Board of Criminalistics (ABC), Society of Forensic Toxicologists (SOFT), and others. As a representative example, the AAFS guidelines include:

- “Every member and affiliate of the Academy shall refrain from exercising professional or personal conduct adverse to the best interests and objectives of the Academy. The objectives stated in the Preamble to these bylaws include: promoting education for and research in the forensic sciences, encouraging the study, improving the practice, elevating the standards and advancing the cause of the forensic sciences.”
- “No member or affiliate of the Academy shall materially misrepresent his or her education, training, experience, area of expertise, or membership status within the Academy.”
- “No member or affiliate of the Academy shall materially misrepresent data or scientific principles upon which his or her conclusion or professional opinion is based.”

Forensic science, in contrast to much of basic science, often is placed in the difficult position at the interface between science and legal advocacy. Science and the law, while having important mutual goals, also have some very significant differences. As mentioned in previous sections, science cannot prove anything beyond simple facts. The law, on the other hand, needs definitive information in order to come to timely and just decisions. Some of the tools presented in this chapter, specifically the scientific method and mathematical constructions, can help to lessen the conflict necessarily caused by these potentially incompatible needs and outcomes. An established code of ethics can help inform and guide scientists as to how to balance the responsibilities of science with the demands of a legal case.

Complicating the picture, of course, is the reality that public forensic science laboratories are most often associated with the prosecution in a criminal case – they receive samples from the police, report analytical results to the district attorney, and appear in court for the prosecution. In some cases, the crime laboratory even reports to and is directly controlled, including financially, by law enforcement. The problem for the forensic scientist in this situation, of course, is to maintain impartiality while performing their expected role in support of legal advocacy.
The Federal Rules of Evidence, the set of rules and practices that controls all aspects of the use of evidence in court, requires that all forensic “results and reports” must be made available to the defense upon request (Rule 16). The question often arises, however, how this rule actually applies. Typically, it has been used by the courts only for final reports and conclusions and not to information about the methods employed, laboratory notebooks and comments, or other records made during the investigation. The defense also usually does not have an automatic right to test or retest themselves the evidence presented. Currently, laboratories usually do not have a legal obligation to permanently preserve records or even the evidence itself, potentially for later retesting.

In 2009, the National Research Council (NRC) of the National Academies of Science presented a report entitled “Strengthening Forensic Science in the United States: A Path Forward.” This in-depth study concluded that many aspects of forensic science practice were deficient and needed careful attention to uniformly bring the practices of the entire forensic community uniformly up to the highest levels of scientific inquiry. Since the publication of this report, numerous working groups and organizations have been tackling the difficult task of raising the scientific standards, establishing strong ethical codes, and implementing changes to laboratory and legal practices to best serve both the scientific responsibilities and the legal needs demanded of the forensic community. While great strides continue to be made, much work is yet to be done – a challenge the forensic community is clearly up to.

Figure 3.3.3. A final thought (Calvin and Hobbes).
Chapter 3 References and Bibliography


Websites:
http://www.quackwatch.org/01QuackeryRelatedTopics/pseudo.html
GLOSSARY OF TERMS

**Confirmatory test**: An experiment designed to simply support the tenants of the original hypothesis or idea itself rather than to be broad-based inquiry in scope.

**Distribution** (statistical): The way that in which the data points spread out over all possible values.

**Error bars**: A line through a data point on a plot indicating the standard deviation for each data point or for each point.

**Ethics**: A part of philosophy that deals with questions that surround our understanding of right and wrong and helps us to decide in difficult cases what is the better pathway to follow.

**Event**: An event is one actual particular outcome, often from among several or many choices, from an experiment. For example, an event would be rolling a four on a die.

**Falsifiability** – The possibility that an hypothesis can be shown to be false by a reproducible observation or experiment.

**Frequency**: The number of times that a particular value or event shows up in an experiment.

**Hypothesis**: A statement or explanation made on the basis of the limited data available that serves as a starting point for further investigation.

**Likelihood ratio** (LR) – The ratio between the probability of two hypotheses being correct.

**Mean**: The sum of the values of each of the individual data points divided by the total number of data points in the set.

**Median**: The half-way point in the data – half of the data points present have greater and half have lesser values than the median.

**Outcome**: One possible result from an experiment.

**Probability**: The field that deals with representing the likelihood that a particular event or set of events will occur given a set of reference data.

**Pseudoscience** (or “junk”, “fringe”, or “alternative” science): The practice or set of beliefs that are not founded in the basics of the scientific method.

**Q-test** (or Dixon’s Q-test): A rough test to justify ejecting an outlying data point from a set.

**Range**: The difference between the lowest and highest value in a set of data.

**Science**: The collective total of our knowledge and understanding, and a process for understanding the physical world.

**Scientific method**: The process by which scientists more formally try to construct an accurate understanding of the things and events around us in reliable and non-arbitrary terms.

**Standard deviation**: A numeric value that gives an indication of the breadth and the distribution of data in a set.

**Standard Operating Procedure** (SOP): A set of rules and procedures for performing an analysis or experiment that conforms to a rigorous standard that is widely accepted as best-practice in the field.

**Statistics**: The field that focuses upon the collection, handling, validation, and interpretation of data.

**Theory**: An explanation that has been generally accepted by a large number of scientists as valid and is supported by a large amount of experimental evidence.
QUESTIONS FOR FURTHER PRACTICE AND MASTERY

3.1. The length of shard of glass recovered from a crime scene was measured repeatedly. Given
the following data set of these measurements, what is the mean, median and standard
deviation?
   1.4, 1.5, 1.5, 1.6, 1.7, 1.7, 1.7, 1.7, 1.9

3.2. Four data points were measured in a blood alcohol determination. These were: 0.024, 0.091,
0.089, and 0.110. Using a Q-test calculation, can the point at 0.024 be eliminated from the
data set?

3.3. What are the majors aspects of the scientific method and how do they work together to form
an unbiased picture of an aspect of the physical universe?

3.4. What are some of the hallmarks used to distinguish pseudoscience from real science?

3.5. What is the role of each of the following in the scientific method: A) Observation B)
Hypothesis C) Prediction D) Experimentation E) Analysis and refinement or abandonment of
hypothesis?

3.6. What is Occam’s razor?

3.7. What is a pseudoscience?

3.8. Give several examples of pseudoscience?

3.9. What are some of the “telltale” features of a pseudoscience?

3.10. What is meant by the term, probability?

3.11. What is standard deviation? What does the value of the standard deviation tell us about our
data?

3.12. What is a Q test?

3.13. What is the function of the American Academy of Forensic Science?

EXTENSIVE QUESTIONS


3.15. Given the following blood alcohol levels determine the standard deviation: .019, .020, .021,
.024, .018, .023, .030, .032, .028, .026, .025.

3.16. Explain the difference between the median and the mean in the following set of points: 9,
12, 14, 10, 18, 20. Under what conditions might the median be more indicative of a general
population conditions than the mean?

3.17. A forensic scientist measures the amount of arsenic in four hair samples. She determines the
amount of arsenic in each sample to be 2.0 x 10^-6 mg, 5.2 x 10^-6 mg, 7.2 x 10^-6 mg and 6.4 x
10^-6 mg. Can she discard the 2.0 X 10^-6 mg measurement as being an outlier?

3.18. What is the probability of drawing three sixes consecutively from a shuffled set of 3 decks of
standard playing cards?

3.19. Using the table below, determine if the 6.2g in the following set of masses can be discarded?
6.2 g, 8.8g, 9.9g, 10.4g, 11.6g