B3- Olympic High School Science Camp

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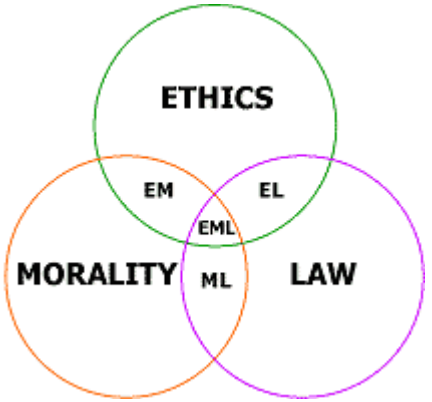
Bioethics

- What is ethics?
- What is the difference between professional and personal ethics?
  - When might they be in conflict?
- How do you learn to think about making ethical decisions?

Definition of Ethics

- "Ethics is the study of ethical behavior, choosing correctly between right and wrong.
  - Morality might be considered the distinction between good and evil – often implies intent rather than outcome alone.
- **Professional** ethical behavior: 'what are the written (and unwritten) rules of the profession'?
  - How does this differ from personal ethics?



From http://en.wikipedia.org/wiki/Ethics

Ethical Relativism says…..

- There are *no* standards or rules of behavior that can reasonably be applied at all times and in all places.
  - Descriptive vs Prescriptive relativism
- Certain principles do recur, or are readily adopted, in many cultures and have persisted throughout recorded history
  - What are they?
  - To whom do they apply?

Why study ethics in science program?

- Formal training is required by some agencies if they give you money (e.g. the National Institutes of Health).
- There are legal consequences to ethical lapses
  - Scandals: the negative attention leads to condemning all of a group for the actions of one member.
  - Conflicts of Interest and Trust: testing ideas means sharing them, and this requires that you trust others to remember whether an idea was yours.
  - Privacy: biomedical data often includes information about individuals that they have the right to consider personal and private.

Poor choices always have consequences

- Biotechnology allows animals to be used to improve human health in various ways:
  - Treat disease, make organs, change nutrition content of food
  - What happens to food safety? Animal welfare? Environmental diversity and safety?

Professional Ethics

- Do scientists have a responsibility to protect society in exactly the same way as any other citizen?
- Do they have any special responsibility that comes from having expert knowledge?
- Whistle blowing is one possible behavior that comes from having special knowledge
  - Obligation to do so?
  - Protections owed?

Ethics: by Example or by Decree?

- You can learn how to behave ethically in two ways:
  - Behavior that is modeled by teachers, mentors, and leaders
  - Rules that are clearly stated, including the reason and limits.
- Ethical issues arise from a number of sources:
  - Ignorance: release of data that allows someone else to invade another's privacy
  - Conflicting directions: 'Do no harm' versus maintaining a life that is full of pain
  - Fuzzy boundaries: admittance to schools based on merit alone versus overcoming years of deliberate inequality

Humans have been proposing ethical theories for thousands of years.

- Rules for Ethical theories:
  - Internally consistent; clear; complete.
  - Parsimonious – not too many special cases
  - Practical and extend beyond a single example

- Classes of Ethical Theories
  - 1. *Teleological* Theories: focus exclusively on consequences of an action.
    - Intention is not relevant.
  - 2. *Deontological Theories*: focus on motivations and intents behind an action.
    - Outcomes are not relevant.
    - Assumption: there is an internal sense of values guiding the action

Ethical Schools

- Utilitarianism-
  - Deciding about whether an action was right or wrong depends on its effects
    - The shorthand is to bring about 'the greatest good for the greatest number'
- Idealism-
  - There is some fundamental standard of right and wrong by which we can judge our actions.

The Utilitarian Approach

- Utilitarianism is a Teleological theory that was developed by Jeremy Bentham and John Stuart Mill in the 19th century – the goal was to produce practical and limited rules for lawmakers, not society.

- The procedure to analyze an issue:
  - What courses of action are available?
  - For each, determine
    - Who will be affected by each action
    - What the benefits or harms will be
    - Are there other consequences or outcomes that are unacceptable?
  - Choose the action that will produce the greatest benefits and the least harm.

Issues associated with this theory

- Which values should be maximized?
- Should utilitarianism be applied to
  - rules (e.g. lying in general)
  - acts (e.g. lying at a particular time).
- Can you really predict consequences of all actions on everyone?

- This easily ends up prescribing actions that are unjust:
  - Most *minority* needs and rights are ignored under this theory – why?

- To be effective everyone must be able to *completely* ignore their own self-interest, autonomy and individual rights in favor of the greatest number
  - Or break down groups such that they are all the same size?

The Rights Approach is an idealistic attempt to give individuals preference over groups

- This is a Deontological theory, started by Immanuel Kant (aka the Categorical Imperative)
  - Autonomy and self-realization are the driving goals
- What are 'the' Rights?
  - Truth
  - Privacy
  - Safety - the right not to be injured
  - Contract - the right to what is agreed
- Assumption –
  - the rights stated above are reasonable and possible to achieve

How easy is it to apply the Rights theory?

- Issues:
  - Sometimes it is impossible to ascertain motivations of a person's actions
  - Sometimes there are bad consequences from a persons actions
    - does it matter if they are avoidable?
  - How is one to resolve conflicting moral obligations?
  - Practicality – it is often difficult to go from Kant's theory to everyday rules.

- What are the consequences of everybody lying (a common action you could present as a form of categorical imperative – a classic logic puzzle is the Cretan informing you that "all Cretans are liars") about research results:
  - All scientists submit fraudulent data as genuine
  - You waste time and money basing your research on their results
  - Destroys credibility of all scientists
  - Precludes the ability of scientific community to make advances
    - For example, no development of cures for diseases
    - No development of life enriching technologies

Ethical Problem Solving -critical thinking

- Always and first: ascertain the facts as accurately as possible
  - Reality is the only sure guide to reproducibility (measurable and testable)

- Then ask the following five questions :
  - What benefit or harm will each action produce; overall what course of action will lead to the best outcome?
  - What rights do the affected parties have, and which course of action best respects those rights?
  - Which course of action treats everyone the same, except where there is a morally justifiable reason not to, and does not show favoritism or discrimination and does not cause irreparable harm to any?
  - Which course of action advances the common good?
    - Is it important that it advance or is it OK if it just doesn't retard common good?
  - Which course of action develops moral virtues?
    - Does a course of action inevitably corrupt moral virtues?
      - "power corrupts, absolute power corrupts absolutely"

Professional Codes of Ethics

- A beginning discussion of the topic can be found at:
  http://www.casanet.org/program-management/volunteer-manage/ethics-today.htm
- Many professional groups have codes of ethics.
  - you may have to discriminate between individual ethics and the ethics, standards and policies of an organization or profession.
  - You may be asked to agree to that code as part of a licensing procedure or to join a society. The code should have:
    - Values: core beliefs that guide actions
    - Ethics: a particular code of values
    - Collective Standards: particular methods of practice
    - Code of Ethics: formal rules which govern behavior of a group
    - Policies: guidelines for behavior in particular situations

Scientific Values

- Scientific methodology and critical thinking skills provide a systematic way to
  - go from observation (data) to theory
  - go from theory to an experiment for collecting more data
  - allow for independent assessment, criticism and testing of all such data and theories
- Purpose:
  - many of the false conclusions / theories / beliefs in the published literature are due to faulty reasoning from possibly impeccable experiments and data.
  - Constant testing is required to uncover and rectify these errors.

- Students are trained, by example, practice, and critical reading, in the principles of experimental design and analysis
- Purpose:
  - For example: learn how to recognize (and avoid performing) poor experiments, incorrect data analysis.

Bad Science vs Misconduct

- Misconduct means actively unethical behavior, flouting the code of the profession.
- Rarely does 'bad science' actually imply unethical behavior.
  - It usually reflects recognition of faulty assumptions and poor logic, methodological mistakes etc.
  - Misconduct would be deliberate carelessness or misleading actions and statements that makes it impossible to identify and correct inaccurate results.
    - The gain may seem somewhat intangible to non-scientists, such as more publications (rather than a monetary reward, for example)

Fraud

- Fraud is a specific *legal* term, and thus tends to be avoided when arguing about unethical scientific behavior.
- Fraud requires proof of all of the following conditions:
  - False representation has occurred
  - The presenter knew that the representation was false
  - A belief in the false data was promoted
  - Others did in fact believe the misrepresentation
  - Damage resulted from the misrepresentation

Scientific Misconduct (DHHS and NSF)

- The general categories are simple and obvious. You should not
  - Fabricate: make up results completely
  - Falsify: tamper with results (careful selection of part of the data)
  - Plagiarize: present another's words or ideas as your own.
- Other serious deviations from accepted practices include
  - It is the responsibility of the individual and of certification groups of professionals to know what the *accepted practices* in their area of expertise are.
    - "ignorance of the law is no excuse"

Deviations

- How to define deviations from "accepted scientific practices"? They include both
  - Written codes and guidelines
  - Unwritten but common practices ('everyone knows': e.g. proper disposal of toxic chemicals after an experiment)
- More specifically the categories are:
  - *Misappropriation*:
    - (A) plagiarism (using another ideas or words without explicitly giving credit or obtaining permission)
    - (B) Revealing information not your own: that is, to make use of any information in breach of any duty of confidentiality associated with review of manuscript or grant application.
  - *Interference:*
    - Take, sequester or damage the research-related property of another (apparatus, materials, writings, data, software).

Misrepresentation

- Fabrication and falsifications – given above
- Omit fact(s) such that the remainder now constitutes a falsehood (see the global warming reports example given above)

- However, misrepresentation can get slippery:
  - For example, "selective use of research data" often occurs in published papers since obvious errors are omitted or indicated only graphically as deviation, and journals require that you provide overall summaries
  - Sometimes the boundary between fabrication and creative insight may not be obvious, although a good scientist will use the preliminary phrase 'one may speculate', for example
- *Obstruction of Investigations* – this is pretty unambiguous
- *Noncompliance with research regulations* – also unambiguous and puts the onus of education on the practitioner to be aware of the relevant regulations

Good Scientific Practice

- Clearly it is not *science* if you can't
  - propose alternative testable hypotheses
    - it must be possible to *perform* the test, in the real world, in which to show that the alternate may be false
      - Intelligent Design has been discredited by all knowledgeable scientists because of this requirement
  - provide multiple ways to interpret data, some of which may be conflicting and therefore require additional experimentation
  - Determine whether there may have been data that turned out to be incorrectly recorded, or a method that had a bug in it that you didn't find in time.
    - You must make sources completely available to the peers if not the public
- For genomics and bioinformatics this has led to community crusades to mandate open data and code access and the preparation of detailed, explicit reporting of methods and techniques
  - the scientific community tries to protect itself against being misled for too long

Accepted Practice

- Some issues are inherently contentious: What is a *serious* deviation from accepted practice
  - Some deviations are the first steps toward new methodologies
  - Some deviations may affect the overall practice of science
    - Using data that is not public, or making assumptions that do not accord with observation

Scientific Practice

- How much can you 'codify' and 'prescribe' behavior?
- The practice of science has rewarded shared values of honesty, collegiality and objectivity.
  - It is also a heterogeneous collection of methods that rely on intuition and selection of 'meaningful' data (not always in ways that seem very objective, or at least that cannot be clearly described as such).
- Professional societies have tried to state and enforce ethical expectations on practice
  - One goal is to prevent government regulation and the growth of bureaucracy.

Critical Thinking

- If you are faced with a situation in which a difficult ethical decision must be made, here is a recommended set of behaviors to follow:
- **Apply Critical Thinking Skills to reach decision**
  - Apply factual knowledge
  - Understand appropriate scientific behavior
  - Separate relevant issues from irrelevant issues
  - Determine the weight to give nonfactual matters, such as opinion and personal experiences and values
    - These are not valueless, but they will be very hard to replicate between individuals

Discussion Issues for Science

- Some practices generally considered central to the correct practice of science include:
  - Have accepted practices for data storage and record keeping been followed?
  - When is it acceptable to use animals or humans in research studies?
    - What regulations and policies apply to such studies?
  - What rules govern conflict of interest, and reporting of potential and real conflicts?
  - What rules govern intellectual property and how do they apply in your work and educational setting?
  - Peer review is central to the scientific review process – what considerations should be given to process, courtesy and confidentiality?
  - How should authorship be assigned on scientific publications?

Possible Discussion Topics for Students

- What are three most important ethical problems that confront you as a student pursuing your education?
  - From your teachers
  - From your peers
- What are the three most important ethical problems that you expect to confront you as a professional in your career?
  - Do you think they will differ at different career stages, such as a beginning professional, when you are a mentor yourself, and if you are a collaborator in a dispersed team.