Sources

- "On Being a Scientist: Responsible Conduct in Research", 2nd ed. National Academy Press, Washington, DC (1995)
- A. Shamoo and D. Resnick, "Responsible Conduct of Research". Oxford University Press, New York (2003)
- F. Macrina, Scientific Integrity, ASM Press, Washington, DC, 5th ed. (2017)
- "Fostering Integrity in Research", National Academy Press, Washington, DC (2017)
- NIH FY 2022 Updated Guidance: Requirement for Instruction in the Responsible Conduct of Research (NOT-OD-22-055)

Those 5 Components

- Format ('Substantial face-to-face discussions')
- Subject matter (see next slide)
- Faculty participation, both 'formal'--within a course--and informal (e.g., in a laboratory setting)
- Duration of instruction (at least 8 contact hours)
- Frequency of instruction
  - throughout a scientist's career
  - at least 1x every 4 years, for trainees

Recommended subject matter

- Scientists as responsible members of society; contemporary ethical issues in biomedical research & environmental/societal impacts of scientific research
- Conflict of Interest-personal, professional, financial
- Policies on human subjects, live vertebrate animal subjects in research, safe laboratory practices
- Mentor/mentee responsibilities & relationships
- Collaborative research (incl. w. industry)
- Peer review
- Data acquisition and laboratory tools; management, sharing and ownership
- Research misconduct and policies for handling misconduct
- Responsible authorship and publication

Scientific Misconduct (and its Implications)

- Over the last 40+ years—
  - # of highly publicized reports of scientific misconduct
    - Summerlin/Good (transplant rejection)
    - Burt (twins & inherited IQ studies)
    - Darsee/Braunwald (drugs for myocardial ischemia)
    - Imanishi-Kari/Baltimore (Abs in mice)
    - Wakefield (vaccine threats to health)
    - Hwang, Kim, Schatten (stem cells)
    - He & Moon (faked e-mail addresses)
    - Obokata, Sasai, Vacanti (stress→ stem cells)

NB: You don't have to be famous to be caught

- "Last year the journal Nature reported an alarming increase in the number of retractions of scientific papers — a tenfold rise in the previous decade, to more than 300 a year across the scientific literature…
- In a recent study, published in the Proceedings of the National Academy of Sciences, two scientists and a medical communications consultant analyzed 2,047 retracted papers in the biomedical and life sciences. They found that **misconduct was the reason for three-quarters of the retractions** for which they could determine the cause" (NY Times, 10/01/12).

- Check out retractionwatch.wordpress.com for descriptions of some recently retracted mss.

Format

- T of C
- Date of expt.
- Title &/or purpose of the expt.
- Description of M & M, if not previously described in your notebook, or in a lab Methods notebook, or in an up-to-date "Current Methods" volume in the lab. If referring to such a 'Methods' volume provide a clear reference in your notebook (volume, chapter title, pages). **NB: any modification to such Methods must be stated clearly**
- Description of Materials, incl. grade & lot #s for chemicals + description of cell lines, bacteria strains, plasmids, etc.
- If materials were supplied by other investigators be sure to identify them. If analyses will be carried out by individual(s) other than you, be sure to name them.

Format (continued)

- Observations & Results: Make sure there is sufficient writing area immediately adjacent to the experimental area so there will be minimal interference with recording the data. Record data directly.
- **Write Neatly!!**
- Calculations, graphs and tables derived from analysis of the data should be entered in the notebook as soon as possible after data recording is complete. Comments and observations should be inserted in the notebook as they are made.
- A conclusion provides a proper finish to the experiment. The conclusion can include plan(s) for future experiment(s).

Electronic Record Keeping

- Spreadsheets (e.g., Excel); data analysis programs (e.g. for statistics, sequence alignment); graphics packages; scanning; digital photography—all make electronic record keeping reasonable + you can store lots of data in a very compact space. This is especially valuable for large data sequences of the type common in molecular biology research.
- Electronic Laboratory Notebook
- "The CLOUD"
- BUT, there are drawbacks and potential problems, as well.
- You MUST maintain the integrity of the data.

Electronic Record Keeping (continued)

- Back up everything!!
- A power outage; a misplaced (or malicious) keystroke, especially if more than one person is entering data on the same computer that you are using; a lost or stolen laptop, can all lead to loads of grief.
- Use a Flash Drive (and a back-up hard drive for all large data sets).
- It may be difficult to always insert an unalterable date/time stamp.
- Ownership of data is really and legally a form of property right (see Chapter 9 of Macrina's book). "Control of scientific data is tantamount to ownership".
- If you have characterized a new drug, gene sequence/pathway and someone inadvertently posts it prematurely on a public database, the entire group's work: priority of discovery; attribution of proper credit; unbiased peer review; obtaining research $$, & maintaining intellectual property protection, incl. patents and licensing agreements can be compromised.