Systems Matter

Research Environments and Institutional Integrity

C.K. Gunsalus
Director, National Center for Professional and Research Ethics
Focus on integrity mindset in research environments to reinforce rigor and reliability.
A longer view is instructive

People are complicated

Context matters

Institutional research environments can be a part of the problem—and should be part of the solution
| RIO: research misconduct allegations, investigations |
| workplace violence team |
| dysfunctional academic units |
| degree revocation |
| department head, dean training, support |
| misuse federal $$ |
| grievance system oversight |
| discrimination harassment |
| bullyproofing academic units |
| campus complaint system |
| internal investigations |
| IRB director, after breach |
We've been talking about some of the same elements affecting the rigor and integrity of research for a long time.
Science, Statistics, and Deception

John C. Bailar III

Annals of Internal Medicine, 1986, 104, pp. 259–260

<table>
<thead>
<tr>
<th>Table 1. Some Practices that Distort Scientific Inferences</th>
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<tbody>
<tr>
<td>Failure to deal honestly with readers about nonrandom error (bias)</td>
</tr>
<tr>
<td>Post hoc hypotheses</td>
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<tr>
<td>Multiple comparisons and data dredging</td>
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<td>Inappropriate statistical tests and other statistical procedures</td>
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<td>Fragmentation of reports</td>
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<td>Low statistical power</td>
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<td>Suppressing, trimming, or “adjusting” data; or undisclosed repetition of “unsatisfactory” experiments</td>
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An Introduction to Research Ethics*

Paul J. Friedman,
University of California San Diego School of Medicine, USA

Keywords: scientific/research integrity, scientific/research misconduct, research ethics, research fraud, authorship

TABLE 1
Research Activities in which Practical Ethical Problems Arise

Data:
- recording and retaining experimental data
- replication (avoid “cutting corners” or taking shortcuts)
- selecting data for publication or presentation
- analysis, including statistics
- sharing of data and research materials
- ownership of records and ideas
- graduate and postdoctoral student rights

Results:
- statistical analysis not done or reported
- premature use in grants (unconfirmed or best results quoted)
- anticipation of results in abstracts (reported experiments not completed)
- exaggerating significance of results (public or scientific deception)
- self-deception (“mythical thinking”) about results or their significance

Publication pressures:
- academic practices that favor long bibliographies
- journal practices that favor short, positive reports
- credit and responsibility should be inseparable

A longer view is instructive
### An Introduction to Research Ethics*

**Paul J. Friedman, University of California San Diego School of Medicine, USA**

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### Table 1

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**High-profile studies typically fail at multiple levels:**

Begley’s six criteria for judging scientific reports:

1. **Were studies blinded?**
   - Almost never

2. **Were all results shown?**
   - **Typically not**
   - “Representative examples” & data selection bias |
   - Western blots that show only a slice; no size markers

3. **Were experiments repeated?**
   - **Often not**
   - Westerns/immuno-precipitation usually only performed once |
   - Typically only use 1/2 siRNAs and in 1/2 cell lines |
   - Confusion between replicates and independent experiments

4. **Were positive and negative controls shown?**
   - **Typically not**

5. **Were reagents validated?**
   - **Frequently not**
   - IHC with a polyclonal anti-peptide Ab |
   - Small molecule inhibitors

6. **Were the statistical tests appropriate?**
   - **Typically not**

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*Note: The text continues with more detailed content not shown here.*
A longer view is instructive
“After all, the ethical conduct of research is central to the integrity of universities, where research and graduate education are inseparable.

… researchers and their universities must accept responsibility for creating an environment in which ethical conduct is commonplace among leaders and expected of all.”
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Paul J. Friedman, University of California-San Diego School of Medicine, USA
Science and Engineering Ethics (1999) 5, 177-178

One must not ignore another important influence on research integrity: the research environment. Unfortunately, momentum is in the opposite direction
Why is so much work not reproducible?

What systems can we put in place to improve reproducibility?
ASK MORE QUESTIONS
What do we know about cognition and decision-making that contribute to this situation?

How can we use what we have learned from advances in understanding, and from experience, to reinforce integrity in research environments?
Career TRAGEDIES

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People are complicated
Sloppy Research Extracts A Greater Toll Than Misconduct

There has been much ado about fraud in science, and even more misunderstanding about its eventual importance to the efficient conduct of science, and our ability to police it. A report on a survey by Judith Swartz was headlined in the New York Times… "...the myth that fraud in science is a rarity" (L. K. Allison, Nov. 23, 1995, page C5). In fact, as the text of the story took pains to emphasize, the study found that a majority of interviewers had heard of an example—in other words, that some fraud had been found out. We have no idea how often the same examples were retold. It is small comfort that such surveys in other fields, not excluding politics, law, and journalism, would give equal or larger scores.

The promulgation of fraud is an outrage, striking at the moral roots of the scientific enterprise. But its moral subtext is large, I submit, compared to its practical importance in most scientific fields. A much larger toll is exacted from inadequate experimental design and sloppy execution. The lost effort that is expended in unweighting out faulty claims, or merely in plowing through their presentation in the literature, greatly exceeds what can be attributed to intentional fraud.

We do not really act solely on the innate virtue of the scientific personality. We are all human, and not equally socialized into the deepest respect for the truth, nor equally well trained to avoid even simple logical and statistical failings. If in the scientific system of organized skepticism, to borrow Robert K. Merton’s phrase, that maintains the integrity of the enterprise.

Scientific claims must enter a cognitive network of great complexity. Rarely is work exactly replicated. Often, that would be uneconomically difficult to do for practical reasons; localized phenomena, availability of reagents, constraints of protocol. But in the work of any real significance it will be built upon the basis for further progress, and these in the ongoing test of the validity of the original findings. When there are discrepancies in the further testing, that is the most likely outcome for a result, a close replication. In high-tech, competitive areas, there is some likelihood of duplication of investigation and contest for priority claims. Fraud may drive evaluation more of the claims for credit than on the validity of the underlying observations.

There are important exceptions to the aforementioned generalizations when the outcome of scientific investigation is every bit into the network of scientific knowledge, but straight into policy. In clinical investigation, particularly, there are grave public consequences, and the costs of objective replication are prohibitive. So I endorse the claim that special safeguards be applied with respect to conflict of interest, expunging of raw data, and so forth in that area. Indeed, many clinical investigations are simply not well-organized in the procedural rigor required by scientific equity.

My own experience over the past 50 years has been that the loss of efficiency in science (fair the more mentioned) is a household greater from egregious slipshodness in experimental design, in self-deception, and in confirmed reporting than it is from intentional fraud. Few and far between—once might even say celebrated—such the cases in which fraud has really been much of a diversion in scientific progress. In fact, much has been made of historic cases of scientific retrenchment of data—Michelson, Mendel—for which there has been no doubt about the substantiality of the final claims.

So why don’t we put more energy into maximizing the rigor and thoroughness of science as it is practiced? Peter C. Balino has commented on efforts to enhance the sophistication of statistical criticism in his paper “Science, statistics and deception,” Annals of Internal Medicine. 104:239-80, 1986). A British group led by J.C. Wyart has designed an expert system, “Predictor,” to assist in the critique of experimental design in clinical trials (Computer Methods and Programs in Biomedicine. 43:283-91, 1994). I would challenge other critics of science to provide more proof-checking paradigms in the broader conduct of science. And that would help to deal with fraud, as well.

New technological modes of publication may help to answer these, especially in assisting the critical discourse that is essential to effective skepticism. There is too high a threshold for publishing a critical note in an unscrupulous error in last month’s journal. We are also deterred by the assumption that merely “someone else would have picked it up.”

The booming advent of electronic media for such discourse gives an easy technical solution to these barriers to the fulfillment of the Republic of Science.

Joshua Lederberg is University Professor at Rockefeller University.

February 20, 1995 THE SCIENTIST 18

COMMENTARY
by Joshua Lederberg
“We are all humans…not equally well trained to avoid even simple logical and statistical fallacies.”

“Scientific claims enter into a cognitive network of great complexity.”

“Loss of efficiency in science [comes from] egregious sloppiness in experimental design, in self-delusion, and in confused reporting.”
“[You] are the easiest person to fool. So you have to be very careful about that. After you’ve not fooled yourself, it’s easy not to fool other scientists…”

Richard Feynman, 1974
“Nothing is easier than self deceit.”

Demosthenes, 3rd Century, BC
Problems ≠ Bad or careless people
Sorting Out the FACS: A Devil in the Details

William C. Hines,1,5,* Ying Su,2,3,4,5,* Irene Kuhn,1 Kornelia Polyak,2,3,4,5 and Mina J. Bissell1,5

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2Department of Medical Oncology, Dana-Farber Cancer Institute, Boston, MA 02215, USA
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http://dx.doi.org/10.1016/j.celrep.2014.02.021

The reproduction of results is the cornerstone of science; yet, at times, reproducing the results of others can be a difficult challenge. Our two laboratories, one on the East and the other on the West Coast of the United States, decided to collaborate on a problem of mutual interest—namely, the heterogeneity of the human of studying cells close to their context in vivo makes the exercise even more challenging.

Paired with in situ characterizations, FACS has emerged as the technology most suitable for distinguishing diversity among different cell populations in the mammary gland. Flow instruments have breast reduction mammoplasties. Molecular analysis of separated fractions was to be performed in Boston (K.P.’s laboratory, Dana-Farber Cancer Institute, Harvard Medical School), whereas functional analysis of separated cell populations grown in 3D matrices was to take place in Berkeley (M.J.B.’s laboratory, Lawrence Berkeley National Laboratory and the Life Sciences Division).
Sure, there are **bad** apples

We are each always individually responsible for our own actions.
And, the barrel shapes perceptions and choices.
**Research tells us:**

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<td><strong>Emphasis on</strong></td>
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<td>performance</td>
<td>mastery</td>
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<td>High stakes</td>
<td>Frequent, low-stakes assessments</td>
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<td>Extrinsic motivation</td>
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<td>Low expectation of success</td>
<td>Path to success</td>
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<td>Peer culture that accepts</td>
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*Context matters*
Consider the **environment**. We know that people are influenced by the choices of those **around** them.
The amount of cheating in which human beings are willing to engage depends on the structure of our daily environment.
Academic Environment

- Star system
- Rewards & incentives
- Grey areas in norms
- Flawed problem reception and resolution systems
Too Many Environments

- Mixed messages
- Results, not process
- Bad examples
- Uneven mentoring
- Abuses of power

- Problem-solving resources
- Suppression of concerns
- Retaliation
Social interactions in LARGE systems are more complex.
By many measures, the biological and medical sciences are in a golden age. That fact, which we celebrate, makes it all the more difficult to acknowledge that the current system contains systemic flaws that are threatening its future. A central flaw is the long-held assumption that the enterprise will constantly expand. As a result, there is now a severe imbalance between the dollars available for research and the still-growing scientific community in the United States. This imbalance has created a hypercompetitive system that is discouraging even the most outstanding prospective students from entering our profession—and making it difficult for seasoned investigators to produce their best work. This is a recipe for long-term decline, and the problems cannot be solved with simplistic approaches. Instead, it is time to confront the dangers at hand and rethink some fundamental features of the US biomedical research ecosystem.

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In the context of such progress, it is remarkable that even the most successful scientists and most promising trainees are increasingly pessimistic about the future of their chosen career. Based on extensive observations and discussions, we believe that these concerns are justified and doubling of the NIH budget ended, the demands for research dollars grew much faster than the supply. The demands were fueled in large part by incentives for institutional expansion, by the rapid growth of the scientific workforce, and by rising costs of research. Further slowdowns in federal funding, caused by the Great Recession of 2008 and by the budget sequestration that followed in 2013, have significantly exacerbated the problem. (Today, the resources available to the NIH are estimated to be at
Mixed Messages

- Hyper competition
- Irresponsibility rewarded (counting papers, H factors)
- RCR low priority, status, funding
- “Responsible research training” is too compliance-focused, poorly timed, often ineffective
- Culture not tended; dysfunctional units
On the Folly of Rewarding A While Hoping for B

“… reward systems that are fouled up in that the types of behavior rewarded are those which the rewardee is trying to discourage, while the behavior desired is not being rewarded at all.”

Steven Kerr
Academy of Management Executive, 1995
On the Folly of Rewarding A While Hoping for B

“... reward systems that are fouled up in that the types of behavior rewarded are those which the rewarder is trying to discourage, while the behavior desired is not being rewarded at all.”

Steven Kerr
Academy of Management Executive, 1995
“The persistence of poor methods results partly from incentives that favour them, leading to the natural selection of bad science.”

—Smaldino and McElreath, 2016
Bringing all these factors together for a wider view...
Challenges start early: Students start in a lab, learn this is how things are done, and develop a mental model of research.
Challenges start early: Students start in a lab, learn this is how things are done, and develop a mental model of research.

Students are dependent on advisor and funding, and reluctant to change even when word of mouth or other experience (RCR training) suggest practice is inappropriate.
Career TRAGEDIES

Temptation
Rationalization
Ambition
Group, authority pressure
Entitlement
Deception
Incrementalism
Embarrassment
Stupid Systems
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**Example:**

We can always justify improper actions to ourselves.

*Think about a graduate student who is about to submit a paper for publication that will determine job prospects.*

- Experiments to complete
- Limited time to repeat and iterate
- Believes the research is good and important work
- Data *almost* tell the best story
Note: Students are even less likely to change if observed practices are “winning”
Loss Aversion

Losses loom larger than gains

Prevention Focus

People take more risks to avoid losses

Think about the mindset of a mid-career faculty member in the context of loss aversion and prevention focus

- People to support
- Grants to secure to keep it all going
- Promotion to full professor
- Papers required to do it all

These factors only intensify as scientists achieve greater professional success.

*The Quarterly Journal of Economics*
CONTEXT → INDIVIDUAL
Focus on integrity mindset in research environments to reinforce rigor and reliability.
Measure it

Recommendation 1: Assess & benchmark
To promote responsible research conduct and fostering integrity, institutions should:

- Establish and continuously measure their structures, processes, policies, and procedures
- Evaluate the institutional environment supporting integrity in the conduct of research
- Use this knowledge for ongoing improvement

Recommendation 1: Assess & benchmark
Survey of Organizational Research Climate (SOURCE)
developed by Brian Martinson, Carol Thrush

Statistically validated with large sample

Scores show correlation between choices and research environment

Benchmarking through two-stage reporting: campus and (anonymized) comparison database


Recommendation 1: Assess & benchmark
Benchmarking power comes from competitive instincts of human beings. Let’s harness that to improve.
Recommendation 1: Assess & benchmark

Survey of Organizational Research Climate (SOURCE)

- Automated data collection through emailed surveys
- Ability to measure success of efforts over time
- Full-service implementations, with consultation and repeat administration

NCPRE on-line engine and benchmark database
Recommendation 1: Assess & benchmark

Measure and assess the integrity of institutional research climates.

Find ways to influence them positively by studying the bright spots.

Give leadership tools for shaping environments
Metrics for ethics

Focus on perceived working conditions could help graduate schools to train responsible researchers.

BY MDNYA BAKER

Training in research ethics is mandatory for many US graduate students and postdocs, but there is little evidence that formal classes prompt scientists to conduct research ethically. However, the workplace climate — which includes perceptions of regulatory committees, data confidentiality and treatment of trainees — influences research practices and can spawn behaviours such as poor record-keeping or plagiarism.

An interdisciplinary team has developed a survey to assess work conditions in research institutions, with a long-term goal of establishing a baseline for measurements of workplace climate across disciplines and universities. The SOuRCe (Survey of Organizational Research Climate) is a 32-question survey that divides workplace climate into seven categories, including integrity norms (such as giving due credit to others’ ideas), integrity inhibitors (such as inadequate access to material resources) and adviser–advisee relations. The team hopes that such data will help institutions to craft policies that will improve research conduct.

Of respondents reported feeling ill-equipped to judge whether university policies support responsible research — which suggests that those topics are not discussed in meaningful ways, she says. Klompers used the survey data by graduate professional and discipline, we can make recommendations,” she says. To encourage participation, she emphasized to respondents that the intended to shame or punish, and respect the process of identifying information.

Brian Martinson studies research at the non-profit HealthPartners in Education and Research in Bloomington, Minnesota, and helped to develop the SOuRCe survey at 40 academic health centres (B. C. J. et al, Sci. Eng. Ethics 19, 813–834; 2013). He has also worked on it in a separate project with MSU, Pennsylvania State University, and the University of Wisconsin-Madison. A poor workplace climate correlates with undesirable research behaviour, and various forms such as data falsification, inappropriate authorship, and fabrication of results.

**ETHICS IN THE ENVIRONMENT**

The level of self-reported fraud, fabrication, and plagiarism increases as perceptions of ‘integrity norms’ fall and of ‘integrity inhibitors’ rise.
Effective, realistic RCR
Research Ethics Programs

By some estimates, institutions devote less than 0.1% of research funding to RCR

Mostly delivered through on-line, multiple-choice programs (89.6% in one survey).

Because they are scalable, and documentable

Even that isn't reliably done

Focus is on rules and compliance vs. real problems encountered in research
One-size-fits-all multiple choice compliance training is not RCR.

Recommendation 2: Better RCR
Real-World Research Needs:

- Professional skills: present research, mentor, support diversity, good laboratory practices...
- How to have a dispute professionally
- How to maneuver in the trenches for getting credit and giving it vs. the formal rules of authorship
- How to choose a mentor and colleagues for character
- The line between making your data look “pretty” and manipulating/altering data and images
- Finding the line between inappropriate self-promotion and advancing your career sensibly
- How to get useful advice, and recognize it, when you encounter a problem
It Should Be:

- Relevant to the audience
- Required for all
- Interactive, experiential; using best practices
- Meaningful: related to work being done
- Delivered at least in part by respected researchers
- Assessed
And, what about that barrel?
Some Factors

- Institutional leadership, structures
- Reward Systems, institutional and individual
- Conflicts of Interest

 Recommendation 3: Improve institutional stewardship
Recommendation 3: Improve institutional stewardship
Why don’t we hold leadership accountable when culture does not support rigor, investigations are botched?
Institutional response to problems: Circling the wagons

Recommendation 3: Improve institutional stewardship
Wrong Questions!

1. “How will this affect our reputation if it becomes known?”
2. “How could anyone think Bill would do such a thing?”
3. “How can we make this go away?”
4. “We don’t have to report this, do we?”
5. “Why would you want to cause trouble for your own research project?”

Recommendation 3: Improve institutional stewardship
…individuals’ evaluations of their own moral transgressions differ substantially from their evaluations of the same transgressions enacted by others.

To the extent that the group stands as an important source of self-definition, one may have an interest in protecting the sanctity of that entity.
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To the extent that the group stands as an important source of self-definition, one may have an interest in protecting the sanctity of that entity.
Bad Practices in University Reports Seen by NSF Office of Inspector General

Snippet is not plagiarism ergo totality is not plagiarism

• Asking leading questions to allow subject to explain a way out instead of asking more pointed questions like “Did you do it?”
• Investigative report lacks supporting evidence and fails to adequately address the elements of a research misconduct finding
• Convene first committee meeting on day 175 (due to OIG by day 180)
• Half page investigation report
• Pre-written admission for grad student; sign or we investigate
• Fail to interview key witnesses

Recommendation 3: Improve institutional stewardship
Investigation Shortcomings

Inadequate reports
Missing elements
Poor record keeping
Evidence ignored
Missed and inadequate interviews
Wrong standards of proof
Misunderstanding “intent”
Wrong definitions
Wrong perspective
Ghost investigation

Recommendation 3: Improve institutional stewardship
"We are pleased with the finding of research misconduct by the federal Office of Research Integrity related to work done by Dr Anil Potti. We trust this will serve to **fully absolve the clinicians and researchers who were unwittingly associated with his actions, and bring closure to others who were affected**”

[institutional representative]

deposition

Q: “Once you started digging, how long did it take you to find the manipulations that had been done?”

A: “It would take you maybe an hour.”
Better Questions

1. “Do we want our names and reputations associated with an institution where dishonest work is countenanced?”

2. “Are there other scholars depending on this work?”

3. “What kind of education are students getting at our institution?”

Recommendation 3: Improve institutional stewardship
Peer Review Institutional Investigation Plans, Reports

* Does the investigation plan identify the right questions and propose a meaningful approach?

* Were the correct people interviewed? All of them?

* Were the relevant data reviewed by appropriate experts?

* Does the investigation report provide factual basis and data?

* Are the conclusions of the report clearly supported?

Recommendation 3: Improve institutional stewardship
“The argument that science must be regulating itself pretty well because it is making progress is far from compelling; perhaps progress would be twice or four times as fast with greater ‘scrupulousity.’”

On Misunderstanding Scientific Misconduct
Paul J. Friedman
Knowledge: Creation, Diffusion, Utilization.
vol. 14 No. 2, December 1992 153-156
Let’s ask more questions:

- Why aren’t we using an empirical approach?
- Why aren’t we assessing our environments?
- Why aren’t we using results to improve?
- Why is doing RCR well such a low-priority?
- Why are only students required to take RCR?
- Why aren’t professional and real-world skills included in RCR?
- Why aren’t we reforming perverse incentives?
- Why aren’t institutional leaders queried about the integrity of their environments?
- Why aren’t investigation reports peer reviewed?
- Why aren’t leaders who preside over botched investigations held accountable?
Let’s get serious about modifying our environments, systems, and practices to reinforce an integrity mindset.

1. Assess and benchmark
2. Better RCR
3. Improve institutional stewardship

Recommendations
We are not as rational as we think we are.

*It’s past time to acknowledge and adjust.*