BASIRA

CANCER METABOLISM
RESEARCH & TRAINING

بصيرة

TRAINING CURRICULUM

CHAPTER TWO

Practice

How we work — integrity, collaboration, and saying it straight

Chapter 1 was about how science reasons. This one is about how scientists behave — and why that is a matter of method rather than manners. Nothing in research is believable unless the people producing it can be trusted.

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Before you begin

It is tempting to read a chapter on integrity as the boring administrative one — the rules you skim before getting to the science. That reading is wrong, and expensively so. Science is a trust system: nobody has time to re-derive every result they build on, so we read what others report and provisionally take it as true. That trust is what makes cumulative knowledge possible, and it is also what makes dishonesty catastrophic.

There is a subtlety here that should change how you read everything that follows. The person you are most likely to deceive is not a reviewer or a rival. It is yourself. Very few integrity failures are the work of a villain fabricating data in the dark. Far more are ordinary people wanting a result to be true, and letting that wish quietly shape a hundred small choices. The safeguards in this chapter exist primarily to protect you from you.

WHERE THIS SITS

	Chapter	What it answers
	1 · Thinking	How does science reason, and how do I avoid fooling myself?
▶️	2 · Practice	How do we behave — integrity, collaboration, communication.
	3 · The Science	What is cancer, and how does a cell power itself?
	4 · Data & Tools	What data exists, and how do we handle it without breaking it?
	5 · The Toolkit	The statistics and code, as a reference you return to.
	6 · Build Your Own	Now go find a question of your own and run it.

WHAT YOU SHOULD BE ABLE TO DO BY THE END

- Name the three bright lines, and explain why they are about intent rather than error.
- Recognise p-hacking, HARKing, cherry-picking and over-claiming — including in your own work.
- Explain why selection and evaluation must not share an axis, and spot when they do.
- Argue why integrity is better engineered into a process than left to good character.
- State what you owe the patients whose data you use, and what authorship actually means.
- Give a critique that is specific, steelmanned and constructive — and receive one without defending.
- Communicate the same result honestly to three different audiences.
- Say what to do the moment you discover you have made a mistake.

2.1 Why integrity is the foundation

A single fabricated result, once published, is built upon by others, cited, extended, and used to justify new experiments. When it eventually collapses, so does everything resting on it — along with the careers and the years that other people invested on its strength. Integrity is not a compliance formality bolted onto research. It is the precondition for research meaning anything at all.

Which is why this chapter is not written as a list of prohibitions. Most of it is about building conditions in which honest work is the easiest thing to do.

2.2 The bright lines

Three violations are categorical. They end careers, they can destroy a group, and there is never a justification for them. Learn them as absolute limits rather than as risks to be managed.

THREE THINGS THAT END A CAREER

Fabrication	Falsification	Plagiarism
Inventing data or results that were never observed.	Manipulating data, images or analysis so the result misrepresents reality.	Presenting another person's work, words or ideas as your own.
e.g. Reporting measurements for samples that were never run.	e.g. Deleting inconvenient points to make a trend look cleaner.	e.g. Copying text or a method into a manuscript without attribution.

These are about intent, not error. An honest mistake is not misconduct — concealing one is.

Figure 2.1 Collectively, research misconduct. Note that each is defined by deliberate misrepresentation — of reality, or of credit.

> ▲ CAUTION — **Being wrong is not misconduct**
>
> None of the three is about error. You will make mistakes — a mislabelled sample, a bug, a wrong assumption — and so does everyone who has ever done research.
>
> What defines these three is the deliberate misrepresentation of reality or of credit. §2.6 is about what to do when you discover an honest mistake, and the answer is never to hide it.

2.3 The grey zone

If fabrication is rare, its quieter cousins are not — and in aggregate they do more damage to the scientific literature than outright fraud, precisely because they feel harmless and are easy to commit by accident. These are the questionable research practices, and you must be able to recognise them in your own work, where they are hardest to see.

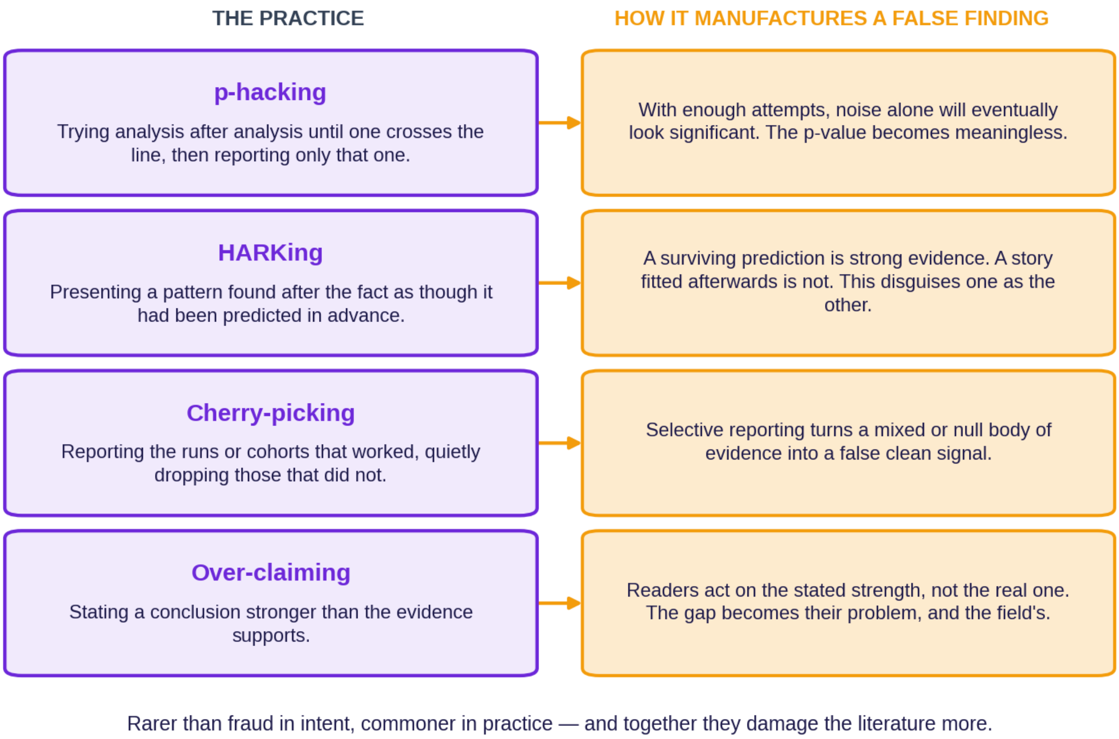

Figure 2.2 Four practices that manufacture findings from noise. None requires a dishonest person — only an unexamined one.

The literature on this is sobering. Given enough flexibility in how data are collected and analysed — the so-called researcher degrees of freedom — a diligent scientist can produce an apparently significant result for almost any hypothesis, entirely by accident. The defence is not to be cleverer. It is to remove the flexibility, by pre-specifying and by reporting everything you did.

2.3.1 The subtlest one: letting selection and evaluation share an axis

One error deserves naming on its own, because it is so easy to commit and so hard to see from the inside. You pick your candidates by some criterion, then validate them using the same criterion.

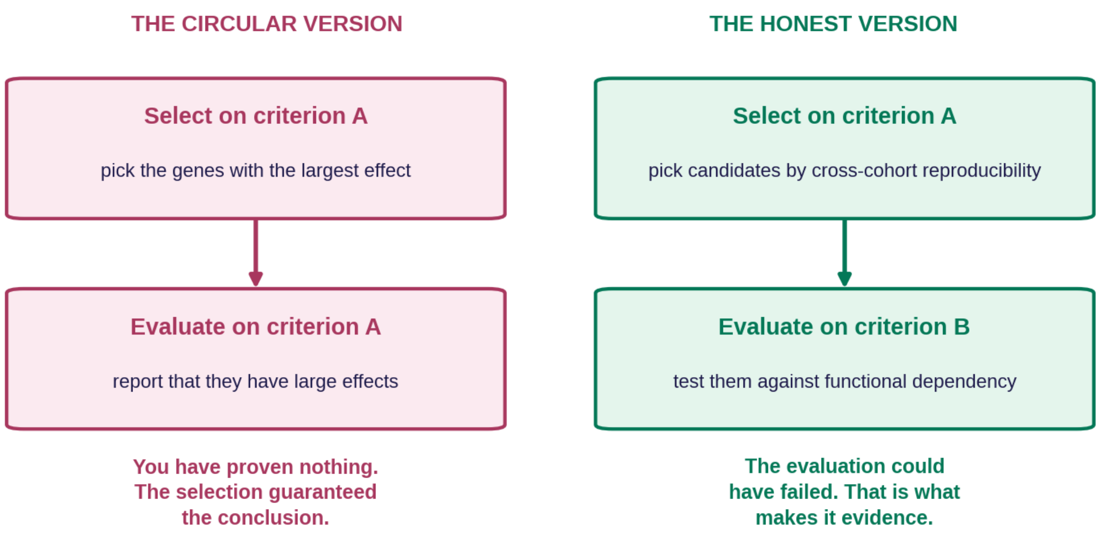

Figure 2.3 If your evaluation could not possibly have failed, it was not an evaluation.

> ◆ **KEY IDEA — The question to ask of every analysis you design**
>
> Is my evaluation criterion secretly my selection criterion in disguise?
>
> If the answer is yes, the result is guaranteed rather than discovered, and it carries no evidential weight at all — however impressive the numbers look.

> **? CHECKPOINT — Checkpoint 1**
>
> Answer these before continuing.
>
> - Name the three bright lines and give an example of each. What do all three have in common? (§2.2)
> - Your analysis produces nothing. You try six more comparisons and the seventh is significant. What is the name for what you have just done, and what must you report? (§2.3)
> - Why do questionable research practices damage the literature more than fabrication does? (§2.3)
> - You select the ten strongest-looking results, then show that those ten are strong. What have you demonstrated? (§2.3.1)

2.4 Structure over willpower

Integrity is usually taught as a matter of character: be honest, be careful. Character matters, but it is not enough, because motivated reasoning operates beneath awareness and willpower is unreliable under the pressure of wanting a result. The more powerful approach is to build a process that makes self-deception structurally hard, so that doing the honest thing is the path of least resistance rather than a daily act of virtue.

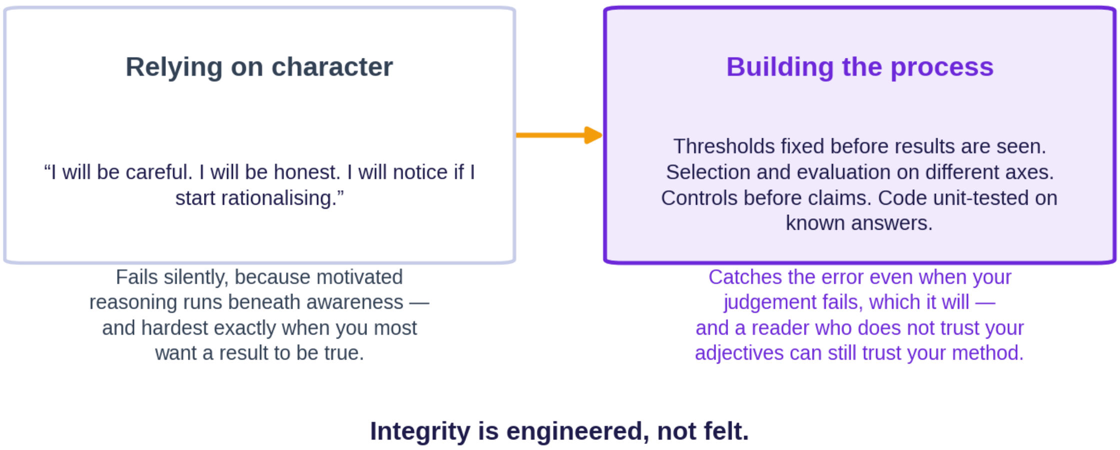

Figure 2.4 You cannot reliably tell, in the moment, whether you are reasoning or rationalising. So do not build a system that requires you to.

Read the engineering of our analyses as applied ethics. Thresholds are fixed in one place before results are seen, so they cannot be tuned to taste. Selection and evaluation run on different axes. Controls run before any claim. What could not be tested is reported as untested rather than negative. Exploratory results are labelled exploratory. Code is version-controlled and produces every number from source. Each of those is an ethical commitment expressed as a technical constraint.

2.5 Data, consent, and credit

Working with human data carries obligations that precede any analysis. The tumour and clinical data we use come from real patients who consented to specific uses under specific protections. We use only appropriately consented, de-identified, publicly released data, strictly within the terms of their data-use agreements, and we never attempt to re-identify anyone. These are not bureaucratic hurdles. They are the conditions under which patients allowed their data to help, and honouring them is part of the science.

Credit has its own ethics. Authorship means substantial contribution to the work — to its conception, its analysis, or its writing — together with accountability for it. Adding someone who did not contribute, or omitting someone who did, both misrepresent who did the work.

> ■ DEFINITION — **Gift and ghost authorship**
>
> Gift authorship adds a name that did not earn it — often a senior figure, often to smooth a paper's path. Ghost authorship omits a name that did. Both are forms of misconduct, and both are common enough that you should expect to encounter them.
>
> When in doubt about who should be an author, or in what order, raise it early and openly rather than

> letting it fester until the manuscript is written.

2.6 When things go wrong

You will make mistakes. An honest error is not misconduct, and it is vital that you understand the difference — because fear of being blamed for honest error is itself a cause of misconduct. It tempts people to hide mistakes rather than fix them, and that is precisely the step that turns an error into a violation.

The integrity test is not whether you erred. It is what you do in the moment you discover it. The answer is always the same: surface it, promptly and transparently. Tell your trainer. Correct the record. If the error reached other people's work, correct it there too. A correction issued for an honest mistake is the mark of a serious scientist.

> ◆ KEY IDEA — **Speaking up is expected of you, not merely permitted**
>
> The same holds when the concern is someone else's work. If something looks wrong, raise it — factually, early, and to the right person.
>
> A group in which concerns can be voiced without fear catches its errors. One in which they cannot, does not. This is a safety feature, and using it is part of your job here.

> ? CHECKPOINT — **Checkpoint 2**
>
> - Why is relying on good character a weaker defence than building a process? (§2.4)
> - Name two specific technical practices that make dishonesty structurally harder, and say what each prevents. (§2.4)
> - What are the two criteria for authorship? Give an example of each way it can be violated. (§2.5)
> - You realise a figure you circulated last week was built from a mislabelled file. Exactly what do you do, and in what order? (§2.6)

2.7 How a research group works

A research group is a system for producing reliable knowledge that no single person could produce alone, and it works only if its parts fit together.

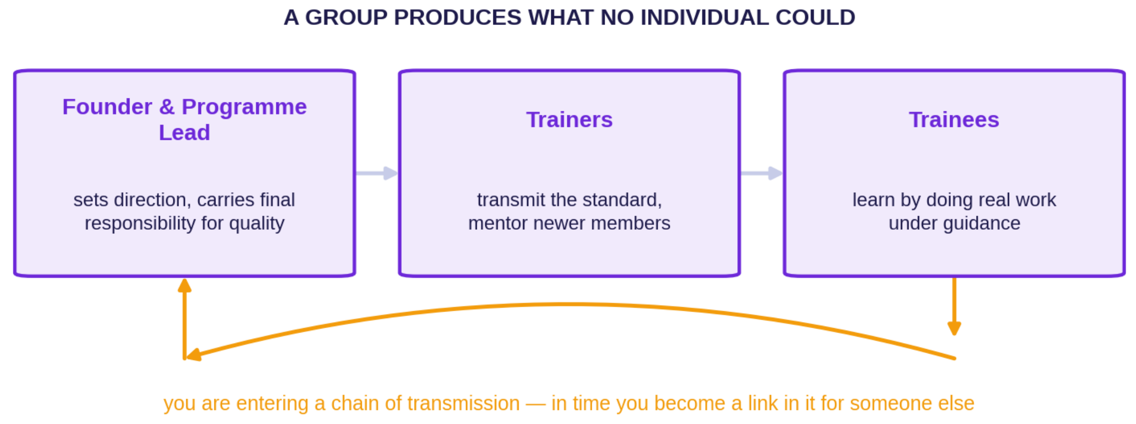

Figure 2.5 Roles, and the loop that matters most: today's trainee is next year's trainer.

Groups also run on shared conventions, and these matter more than they first appear. When everyone lays out files the same way, names things the same way, and uses the same agreed thresholds, any member can pick up any other member's work and understand it. Follow the conventions even when your own would have been marginally nicer. The value is in everyone using the same one.

2.8 Critique, given and received

Science runs on criticism. A result that has not been challenged has not been tested, and the most valuable thing a colleague can do for your work is find its weaknesses now, while they are cheap to fix. Learning to participate in that well is a real skill, not a personality trait.

The governing principle is to separate the idea from the person. Criticism of your analysis is not criticism of you; it is a collaborator helping the work get stronger. Internalising that turns a defensive reflex into curiosity, and it is the single biggest determinant of how fast you will grow here.

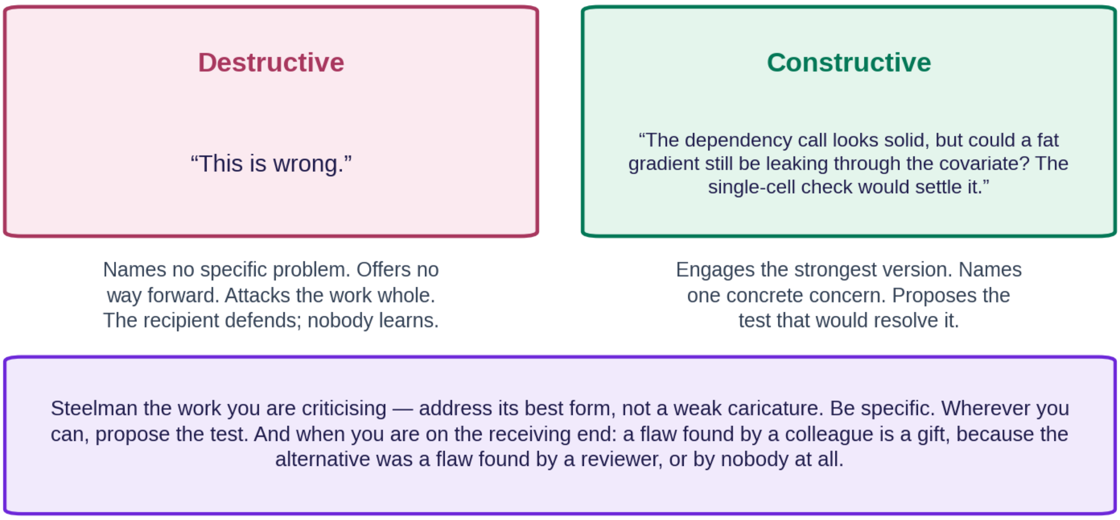

Figure 2.6 The difference is not tone. It is whether the critique gives the other person somewhere to go.

When a genuine disagreement cannot be resolved, the working rule is disagree and commit: argue your case as well as you can, and once a decision is made, support it and move forward rather than relitigating it indefinitely. Neither silent resentment nor endless reopening serves the work.

2.9 Your code and data are shared property

An analysis is not finished when it produces the right answer on your machine. It is finished when a colleague can run it, get the same answer, understand what it does, and build on it. This reframes a great deal of what might look like private technical housekeeping as, in fact, an act of collaboration.

Loaders that fail loudly with a clear message spare a colleague hours of confused debugging. Unit tests on synthetic data let someone change the code confidently without silently breaking it. Provenance from source to figure lets anyone verify a claim without having to ask you. Write your code as though the next person to run it is a colleague you respect — because it is, and because within a few months that person is you.

? CHECKPOINT — Checkpoint 3

- What does the group gain from shared conventions that individually optimal choices would lose? (§2.7)
- Rewrite this as constructive critique: “your analysis is a mess.” Invent whatever detail you need. (§2.8)
- What does “disagree and commit” mean, and what two failure modes does it prevent? (§2.8)

- Give three concrete things that make an analysis usable by someone other than its author. (§2.9)

2.10 Knowing your audience

The same result must be communicated differently to different audiences, and doing so is not spin — it is respect for the listener — provided the content never bends in the process.

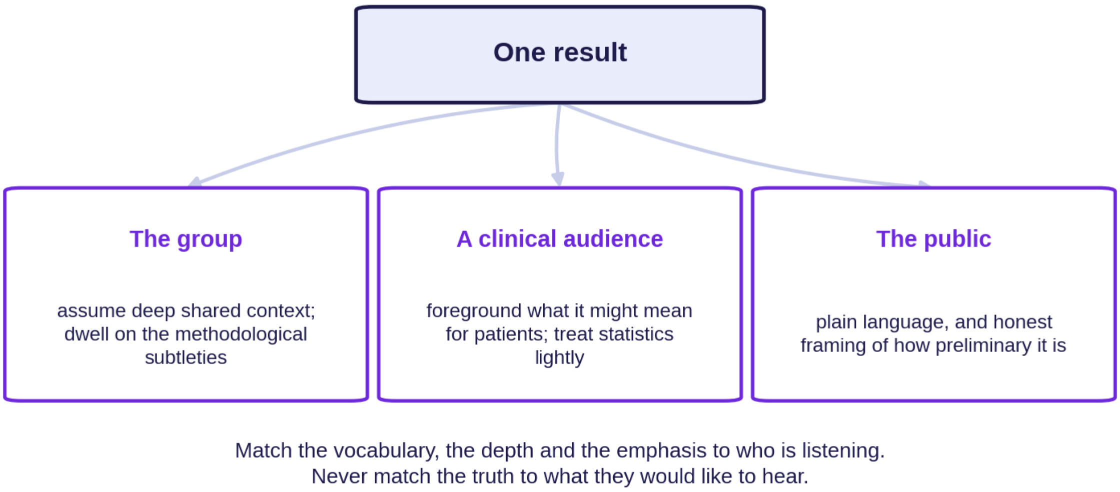

Figure 2.7 The vocabulary, depth and emphasis change. The claim does not.

2.11 Figures that do not mislead

A figure is an argument made visually, and like any argument it can illuminate or deceive — often without the maker intending the latter. The obligation is to let the reader see the evidence honestly.

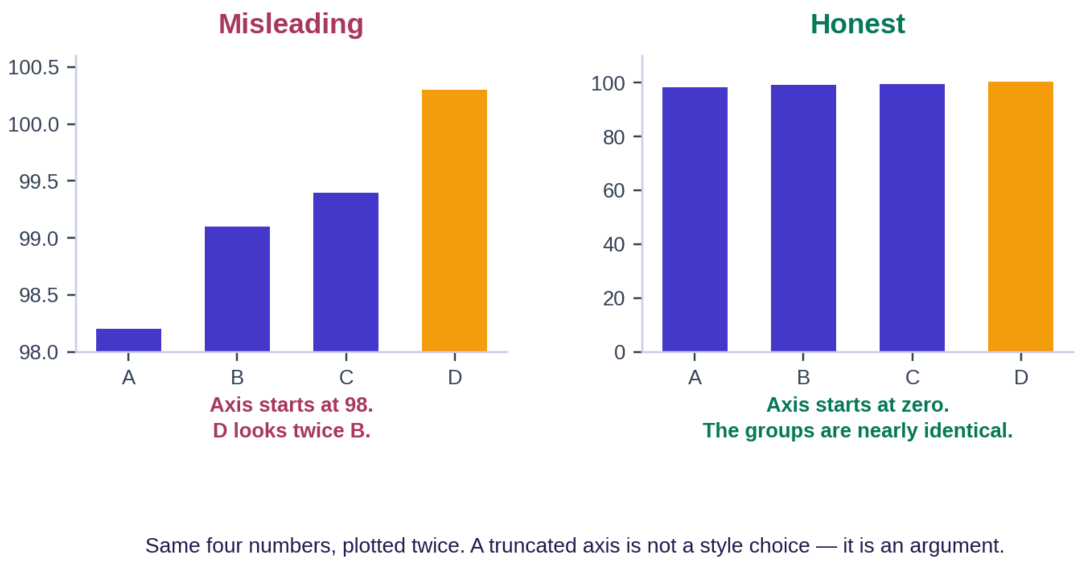

Figure 2.8 The single most common way an honest person misleads with a chart.

- **Show the data,** not merely a summary that hides its spread.
- **Do not truncate or stretch axes** to make a modest effect look dramatic.
- **Label everything** so the figure stands on its own, away from your caption.
- **Make uncertainty visible** rather than implying a precision you do not have.
- **Compute every value from source.** Nothing is nudged by hand to look better.

> ▲ CAUTION — **A misleading figure is not a communication error**
> It is an integrity error wearing a communication costume. The reader cannot tell the difference between a chart that deceives on purpose and one that deceives by carelessness — and neither can your reviewers.

2.12 Writing, presenting, and “I don't know”

Most scientific writing follows a logic the reader depends on: what question you asked and why it matters, how you tried to answer it, what you found, and what it means. Serving that logic — rather than showing off — is the whole job. Clarity beats cleverness every time; if a reader has to work to decode your sentence, the fault is yours. And cite scrupulously: every idea, method or result that is not your own is attributed to whoever it belongs to.

A talk is not a paper read aloud. An audience can hold only a few ideas at once, so a good talk carries one clear message, signposts where it is going, and does not crowd every slide with detail. Be honest about limitations in a talk exactly as in writing; an audience trusts a speaker who volunteers the weaknesses.

◆ **KEY IDEA** — **The most underrated sentence in science**

“I don't know” is a complete and respectable answer. Bluffing to seem authoritative is both an integrity failure and a transparent one.

“I don't know, but here is how I would find out” shows far more command than a confident guess. The point of a scientific talk is to be understood and to be right — not to appear invulnerable.

2.13 End-of-chapter questions

Write a paragraph on each and bring them to the session. Several have no single right answer.

- Describe a situation where you can imagine yourself committing a questionable research practice without noticing. What process, specifically, would catch you?
- A senior colleague asks to be added as an author on your paper. They gave you the idea in a corridor conversation and read one draft. Argue both sides, then say what you would do.
- You are asked to present a null result to a room hoping for a positive one. Write the opening two sentences of that talk.
- Find a published figure — in a paper, a news article, anywhere — that misleads. Explain the mechanism, and redraw it honestly.
- “Integrity is engineered, not felt.” Argue against this claim as strongly as you can, then respond to your own argument.
- You discover a colleague's analysis has a bug that changes their conclusion. Write exactly what you would say to them.
- What would have to be true about a research group for someone junior to feel safe reporting a mistake? List five concrete things.

2.14 Go deeper

Every link is live. [Watch] is video, [Read] is written, [Source] is the original paper.

START HERE

[Watch] **Crash Course Scientific Thinking #4 — Peer Review and the Quest for Truth** — How claims get checked before anyone is allowed to believe them. Opens on a real retraction.

[Watch] **Crash Course Scientific Thinking — full series** — If you have not watched it yet from Chapter 1, watch it now.

ON THE GREY ZONE

[Source] **John, Loewenstein & Prelec (2012) — Measuring the Prevalence of Questionable Research Practices** — Researchers were asked, anonymously, how often they did these things. The numbers are the point.

[Source] **Simmons, Nelson & Simonsohn (2011) — False-Positive Psychology** — Demonstrates researcher degrees of freedom by using them to prove something impossible.

[Read] **Retraction Watch** — A running record of papers withdrawn and why. Read a week of it and the grey zone stops being abstract.

ON CREDIT AND CONDUCT

[Read] **ICMJE — recommendations on authorship** — The criteria most biomedical journals actually apply. Short, and worth reading before your first paper.

[Read] **Committee on Publication Ethics (COPE)** — Flowcharts for what to do when something goes wrong — including when you are the one who erred.

[Source] **Feynman (1974) — Cargo Cult Science** — Caltech commencement address. Read it again after this chapter; it lands differently.

2.15 Glossary

Authorship Substantial contribution to a work's conception, analysis or writing, together with accountability for it.

Cherry-picking Reporting the runs, cohorts or subgroups that worked while quietly dropping those that did not.

Conflict of interest Anything that could bias your judgement, or be perceived to. Disclosed rather than hidden.

Disagree and commit Arguing your case fully, then supporting the decision once made rather than relitigating it.

Fabrication Inventing data or results that were never observed.

Falsification Manipulating data, images or analysis so that results misrepresent reality.

Ghost authorship Omitting someone who did meet the criteria for authorship.

Gift authorship Adding someone as an author who did not meet the criteria.

Motivated reasoning Letting a wish for a particular conclusion shape the many small choices in an analysis, beneath awareness.

Plagiarism Presenting another person's work, words or ideas as your own.

p-hacking Running analysis after analysis until one crosses the significance threshold, then reporting only that one.

Questionable research practice (QRP) Conduct falling short of misconduct that nonetheless inflates apparent evidence.

Research misconduct Fabrication, falsification or plagiarism. Defined by intent, not by error.

Researcher degrees of freedom The many undocumented choices available in collecting and analysing data, which together allow almost any result.

Steelmanning Engaging the strongest version of an argument or piece of work, rather than a weak caricature of it.