Research Methodology, Ethics & Communication
Core course for 2nd yr. Ph.D./Int.Ph.D. students in Physics/Maths

Instructor : R. Loganayagam.

August 18, 2023

1 Basic Info :

- **Instructor name :** R.Loganayagam,
- **Tutors :** Vinay Kumar, Shridhar Vinayak .
- **Venue :** Feynman Lecture Hall.
- **Timings :** 15:30 to 17:30 hrs (Monday,Friday)
- **First Class (Introduction) :** Friday 15:30 to 17:30 hrs, 18th Aug, 2023
- There will be no drop test for this course.
- **The grading policy** will be based on the following weightage :
  - Class participation/presentations : 50%
  - Written Assignments : 50%

This is a core course designed to train students in skills crucial to research. Since class participation is very important in such a course, I will insist on proper attendance and active participation. I will keep track of your attendance for this reason.

Because of UGC requirements, from this year onwards, the ethics component of this course will be graded **separately** (2 credits). Note that this is an advanced 4-credit course on research methodology, ethics and communication compulsary for all second year physics/maths students enrolled at ICTS : it should not be confused with the 2-credit seminar course for the first year students (that one is being re-labelled to Research Methodology I from this year onwards).

2 Course objectives

The declared objectives of the course are as follows: on completing the course, the student should be able to

1. Appreciate the variety of motivations behind the scientific endeavor, understand various historical, sociological, and philosophical ideas about science (including scientific method) and comprehend the limitations of these ideas.

2. Understand how research problems and the methods to solve them are chosen and learn how to adopt a focused critical approach towards the scientific literature.

3. Comprehend the different approaches towards ethics and how they are employed in thinking about research ethics. In particular, the student should be able to understand the advantages/limitations of value-based vs rule-based approaches.

4. Recognise, detect and avoid plagiarism, falsification, and data fabrication as well as understand the importance of good documentation practices in fostering independent/critical thinking.

5. Identify and tackle ethical issues arising in the context of authorship, mentorship, collaboration, and peer review using both value-based and rule-based approaches.

6. Articulate the social responsibilities of scientific practice and understand the conflicts of interest arising from personal, institutional, political, and corporate commitments. The student should also be able to comprehend the responsibilities towards the environment, living subjects, etc., as well as be able to recognize and tackle ethical issues arising from social inequalities.

7. Understand the different formats of scientific text (proposals, reviews, papers, referee reports, responses, etc.) and employ the structure and style appropriate to the context.

8. Understand the principles of rhetoric, its phases (invention, arrangement, style, memory, and delivery), its modes (ethos/pathos/logos), and know how to use them effectively in scientific arguments/communication.

Please read these objectives carefully and make sure you understand them clearly. I will be happy to clarify if any of the objectives listed above are unclear.

3 Course Philosophy

The rationale for this course comes from the belief that there is some value in having our graduate students think about research, ethics, writing, talks, etc., seriously right from the beginning. That these topics belong together and should be learned/taught in tandem is not self-evident, and so a justification is in order.

Scientific community

What does communication(writing/talks etc.) have to do with the 'scientific method'? In turn, why should these two be linked with issues on research ethics? The crucial links between these ideas are not at all obvious to a beginning graduate student and even seasoned researchers understand these relationships only at a very vague intuitive level.

To clarify the link, let me begin by arguing for the following assertion: **Scientific communication is the foundation of science.**

As scientists, we assume by default that individual human beings are prone to mistakes. They are biased by their prejudices and overlook crucial facts that contradict their hypothesis. Having accepted this fact, how is science posiible at all? How do we ever hope to find scientific truths about nature? The crucial answer that the so-called scientific method provides to this dilemma is as follows: although individuals are fallible, this fact can be dealt with by building a *scientific community.*

The concept can be roughly described as follows: any individual with an idea or observation communicates it *clearly and honestly* to a scientific community. This is done by speaking and writing about the idea, providing proper context, details, and caveats with due honesty. Other individuals in the scientific community listen to, question, test, debate, and critique the idea or observation in good faith. This critical assessment is then communicated back clearly and honestly to the original person. We then hope that this cycle of careful tests and observations, clear speaking and writing, critical reading and listening within an intellectually diverse, ethically committed, and socially connected community overcomes our individual shortcomings. It is not immediately obvious that this method will work, but the history of science shows that, as a strategy, it is more successful than any of our ancestors might have imagined.

We do science by creating a scientific community, and by building institutions that support such a community. We foster communication by means of our talks, lectures, colloquia, workshops, conferences, papers, reports, and journals. We encourage a culture of careful thinking, skepticism, honesty, hard work, ethical conduct, and congeniality by fostering good practices within these institutions. We inspire each other with our questions, our curiosity, our courage, our hard work, our excellence, our ethical standards, our ambition, our friendships, our collaborations, and by our rivalry. This description should make it clear that ethics and communication are not an afterthought in science, but rather the very bedrock on which science is built.

This fact is why the birth of modern science in history is marked by the spreading of printing press, an increase in literacy, the development of papers/ journals, as well as the formation of universities and scientific societies which encouraged 'gentlemanly' conduct, skepticism and honesty. This is why the history of physics, Science, Europe, and the world at large was substantially transformed with the creation of say the Royal Society and the emergence of the Republic of Letters. This explains why the world wide web was invented by scientists to talk to other scientists. This is the major reason why an individual is often more productive when he/she is part of a larger well-connected scientific community that values hard work, creativity, competition, critical thinking, ethical conduct, and clear communication. This is also why, here at ICTS, we strive to encourage seminars, workshops, conferences, and outreach.

A little thought should convince the reader that, without scientific communication, critical evaluation, and without a minimum ethical commitment, the scientific method cannot operate on an idea or an observation. It follows that *an idea or an observation becomes science only when it is communicated clearly, received critically, and is deemed trustworthy. An idea can claim to be a part of a scientific endeavor only when its relation to other scientific ideas has been made explicit, and it is assimilated into science only after it has been checked and clarified in a variety of different settings.*

As scientists, we try to be precise and logical in our thinking, writing, and speaking as well as in our reading and listening. We act in good faith: we strive to trust and be trusted, strive to understand and to be understood, strive to question and be questioned. To be a good scientist is to be a good thinker, a good listener, a good writer, a good speaker, and a good communicator. We spend a lot of time anticipating the questions that our potential audience would ask, and how those queries could be addressed appropriately. We also try, despite our deeply held prejudices, to be the best possible critics of our own ideas and those of other scientists.

It is against this idealized (some might say over-romanticized) picture of the scientific community that we can judge our failures. While the last few centuries have seen great progress driven by sciences, the history of science is also filled with many missteps and mishaps (also many outright frauds and lot of cases laced with blatant prejudice). There is much that is fallible in human nature, and history shows that all these flaws hitch-hike onto the scientific practice. It is thus essential that practicing scientists learn to diagnose and deal with such failures. We should also be aware that some of the most insidious of these influences are hard to correct, and can only be mitigated at best by building good institutions.

A more cynical line of argument for the same conclusion is as follows: the scientific community (like other communities built on social, political, economic, ethnic, or religious similarities) has certain aims and aspirations. Like any other human community, these aims are achieved by procuring access to money, talent, material resources, social recognition, media presence, state power, etc. This is, in turn, achieved by co-opting and contesting existing human institutions, as well as creating new institutions to achieve certain ends. Phrased this way, we are inevitably led to ask: which kind of aspirations are legitimate? what kind of scientific agendas and access to power are morally defensible within a given society? How does one ensure that the power so acquired is not abused? When faced with an abuse of power, how should the scientific community respond? Such questions almost never have simple answers. But to sweep them under the carpet, to ignore them, would eventually imperil the entire scientific enterprise. Scientists cannot play naive when so many social, political, economic/religious agendas seek to co-opt scientific research and hard-earned scientific prestige for their own ends.

The above description shows how the various ideas in this course are intimately linked. To summarise, the scientific method is about the scientific community, and the scientific community is built on certain foundational commitments: commitments of creativity and hard work, critical thinking and constructive skepticism, honesty, and ethical conduct, and clear communication of what one thinks and knows. Once these facts are recognized, it becomes clear why a graduate student should be trained in all these skills in order to do research.

On writing

Among all forms of scientific communication, writing is the most elaborate and the most enduring. As a part of your graduate study, you will be required to write a lot: term papers, thesis proposal, research papers, referee reports, replies to referee reports, assessments, talk abstracts, posters, and finally the Ph.D. synopsis, and Ph. D. thesis. If you choose to pursue a scientific career further, more writing will be called for over and above these forms: recommendation letters, review articles, lecture notes, assignments, grant proposals, conference proposals, textbooks, news articles, press releases, and progress reports. It is truly mind-boggling to contemplate how much writing dominates academic life. To a first approximation, scientists are one of the prolific writers. Not just that, scientific writing is also exceptional in that much of it is multi-authored and involves people drawn from a diversity of backgrounds. Given these facts, the earlier you learn to write well, the better it is.

The first rule of writing is that good writing takes time and effort. As in all creative endeavors, good writing is often a lifelong pursuit and requires a lifelong commitment. Even the most seasoned researchers among us have a lot to learn regarding writing. The good news is that writing can be learned through practice, feedback, and self-evaluation.

Often beginning graduate students have many mistaken impressions regarding research writing. Many have the following flawed idea of how a paper is written : In the first step, one learns lots and lots of *stuff*. Next, by some mysterious means, a problem just appears. One then starts measuring/calculating and in due time finishes the work. Then, the researcher sits down on a day to pour everything out of his/her brain into a document which then becomes a paper. This cartoon picture of research and writing is quite far from reality.

The flaws in this way of thinking are too many to enumerate. The main flaw is to think that writing happens at the end and solely for the sake of communication. It completely misses the crucial fact that **writing is a central tool for research and critical thinking. It is not merely a mode of communication !** The reality is that you need to start writing from the very beginning. Every step mentioned above requires writing: you learn new things by writing about them. You stumble on problems and figure out what needs to be done by writing. You keep track of computations/observations by writing. You find flaws in your logic (and that of the others) by writing. It is by writing that you know when you have a coherent enough story for a research article. In short, research is done by writing at every step.

Why do you need to start writing right from the start? Here are some reasons :

- Many times, only after you start writing, do you realize that an apparently brilliant line of argument is actually full of logical holes. Writing with repeated revision is a powerful tool for the analysis of ideas. A written note helps us distance ourselves from our own ideas which is essential to critically evaluate them.

- Often at the end of a project, you might be bored and exhausted, and perhaps a deadline is hanging above your head. Perhaps you have moved on to new computations. If you have not written anything till then, it is probable that you cannot write anything, let alone write well or give the scientific idea the time and effort it deserves.

  Further, one of the worst nightmares for an active physicist is to be 'scooped', i.e., somebody else may publish an idea/result that you have been working on for months/years. Sometimes, you need to then respond by publishing immediately and you will need a well-written document to pull off such a publication deadline.

- The power of ideas expressed in a written text should not be underestimated. It sparks new ideas and allows us to see new connections between existing ideas. It enables us to recursively build new arguments over existing insights, and clarifies the overall structure of disparate facts. It stands the test of time even after all of us are dead and decomposed. It is for this reason that written texts are used to great effect by literature, law, science, and religion. It is important to pause and reflect on how words written many thousands of years ago (e.g. by Euclid) still continue to influence us.

- If you are collaborating with others in your research, a written note helps them understand what you have done. Writing is a powerful form of communication and an essential tool in collaboration.

- I think every scientist has their own scientific voice, i.e., the way one phrases ideas and draws connections. Every single person has their own scientific style and a scientific accent. In my opinion, an important goal of a Ph.D. is to find one's own scientific voice. Thus, it is especially important for a beginning scientist to learn to write, for writing is the best way to discover one's own scientific voice.

One can go on in a similar vein, but hopefully, these reasons are sufficient to convince you why it is important to start writing from the very beginning.

4 Suggested references:

No single textbook covers the entirety of the objectives of this course. So I give below a set of texts which have appealed to me at various levels, separated topics-wise. The list here is somewhat long: I was motivated to put together such an extensive list by the difficulties I faced in finding reading material relevant to this course. Please contact me in person if you wanted to know about my individual opinion on these texts including their strengths and weaknesses.

4.1 Miscellaneous References:

You will be doing a lot of writing in this course. The writings have to be submitted in LaTeX format. I will assume that all of you are familar with basic high school level English grammar and composition at the level of the textbook by Wren and Martin. For LaTeX, searching online as you write is the quickest way. Here are some resources I have found useful :

1. LaTeX in 24 Hours : A Practical Guide for Scientific Writing by Dilip Datta
   `https://link.springer.com/book/10.1007%2F978-3-319-47831-9`
2. More Math Into LaTeX by George Grätzer
   `https://www.springer.com/gp/book/9783319237954`
3. LaTeX and Friends by Marc van Dongen
   `https://www.springer.com/gp/book/9783642238154`
4. LaTeX templates : `https://www.latextemplates.com/`
5. LaTeX resources by Ryan Higginbottom
   `http://www2.washjeff.edu/users/rhigginbottom/latex/resources.html`

Many of the core topics of this course have an overlap with philosophy. The relevant fields here are Epistemology (dealing with knowledge), Ethics (dealing with morality), Logic and Rhetoric (dealing with debate, argument and persuasion). We will also be interested in history and sociology of science which contain many valuable insights on how research has been done in the past. Our attitude towards all these subjects in this course would be similar to how say mathematics is treated within the physics core courses: we will acknowledge it as essential and try our best not to oversimplify the perspectives provided by these fields. At the same time, we will also take a pragmatic approach that steers clear of deep waters.

Some good references on philosophy of science are

1. Philosophy of Science for Scientists by Lars-Göran Johansson
2. Worldviews: An Introduction to the History and Philosophy of Science
   by Richard DeWitt
3. An Introduction to the Philosophy of Science by Kent W. Staley
4. Theory and Reality – An Introduction to the Philosophy of Science by Peter Godfrey–smith
5. Stanford Encyclopedia of Philosophy
   `https://plato.stanford.edu/contents.html`

The Stanford Encyclopedia is often a useful resource with accessible summaries of relevant issues. For anybody who is interested in the broader history of human philosophy, I will easily recommend *History of philosophy without gaps* (`https://historyofphilosophy.net`), a podcast series by Peter Adamson. While I do not expect students to have a familiarity with the topics discussed in above references, an openness to consider them as they go along is a pre-requisite.

History of science is also a vast field and I will again give some of my favourite introductions:

1. Science and Technology in World History by James E. McClellan and Harold Dorn,
2. The Beginning of Western Science by Lindberg, David C
3. The Invention of Science: A New History of the Scientific Revolution by Wootton, David
4. The Physicists – The History of a Scientific Community in Modern America by Kevles, Daniel J.
5. Horizons: A Global History of Science by Poskett, James
6. Cosmos – An Illustrated History of Astronomy and Cosmology by North, John

Since we will be talking about ethical conundrums in science, it is useful to have some historical perspective on some of the issues that have historically showed up in the intersection between science and politics. I found the following texts to be interesting in this regard:

1. Hitler's Scientists: Science, War, and the Devil's Pact by Cornwell, John
2. Serving the Reich: The Struggle for the Soul of Physics under Hitler by Ball, Philip
3. Big Science: Ernest Lawrence and the Invention that Launched the Military-Industrial Complex by Hiltzik, Michael.
4. The Making Of The Atomic Bomb by Rhodes, Richard
5. In the Shadow of the Bomb - Oppenheimer, Bethe, and the Moral Responsibility of the Scientist by Schweber, Silvan S.,
6. Nucleus and Nation - Scientists, International Networks and Power in India by Anderson, Robert S.
7. Stalin and the Scientists: A History of Triumph and Tragedy 1905-1953 by Ings, Simon
8. Stalin's Great Science: The Times and Adventures of Soviet Physicists by Kojevnikov Alexei B
9. American Science in an Age of Anxiety: Scientists, Anticommunism, and the Cold War by Wang, Jessica.

4.2 Research Methodology References:

It is common to find that a course of this sort includes a discussion of precision, curve fitting, estimation of uncertainties etc., in the research methodology module. I will assume that all of you have encountered this material in your previous courses: if you are not confident of this material, I will urge you to refer to the books listed below. An elementary discussion of probability and statistics (including error analysis) can be found in the following undergraduate texts :

1. Introduction to Probability And Statistics for Engineers and Scientists
   by Sheldon M.Ross
2. Probability and Statistics for Engineers and Scientists
   by Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying E. Ye .
3. Measurements and their Uncertainties: A practical guide to modern error analysis
   by Ifan Hughes, Thomas Hase
4. Introduction To Error Analysis: The Study of Uncertainties in Physical Measurements
   by John R. Taylor
5. Research Methods For Science by Michael P. Marder

On Research : We will start with self-help-style books addressed to science Ph.D. students. The quality of advice here varies somewhat, but all of them are good books to read. My favorites appear at the beginning of this list:

1. The Art of Being a Scientist by Roel Snieder and Ken Larner
2. The Unwritten Rules of PhD Research by Marian Petre and Gordon Rugg
3. Advice to a Young Scientist by Peter Medawar
4. Letters to a Young Scientist by Wilson, Edward O
5. Ignorance: How It Drives Science by Stuart Firestein
6. Failure: Why Science Is So Successful by Stuart Firestein
7. The Craft of Research by Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams, Joseph Bizup, and William T. Fitzgerald.
8. The Art of Scientific Investigation by William Ian Beardmore Beveridge
9. Winning The Game Scientists Play by Sindermann, Carl.
10. Building a Successful Career in Scientific Research: A Guide for PhD Students and Postdocs by Dee, Phil.
11. Scientific Research as a Career by MacRitchie, Finlay
12. Becoming a Successful Scientist: Strategic Thinking for Scientific Discovery by Loehle, Craig
13. Who Wants to be a Scientist?: Choosing Science as a Career by Rothwell, Nancy.

14. So You Want to be a Scientist? Schwartzkroin, Philip A.
15. The Effective Scientist: A Handy Guide to a Successful Academic Career A Handy Guide to a Successful Academic Career Bradshaw, Corey J. A., Campbell, René.
16. The Scientific Endeavor: A Primer on Scientific Principles and Practice by Lee, Jeffrey A.
17. An Introduction to Scientific Research by Wilson, E. Bright

On Critical thinking : Next is a list of books on critical/scientific thinking. I have also included in the list texts which discuss the nature of science and pseudo-science.

1. Critical Thinking Skills by Stella Cottrell
2. A Workbook for Arguments: A Complete Course in Critical Thinking by Anthony Weston and David R. Morrow
3. Critical Reading and Writing for Postgraduates by Alison Wray and Mike Wallace
4. Critical Thinking Skills For Dummies by Martin Cohen
5. The Critical Thinking Toolkit by Galen A. Foresman, Jamie Carlin Watson, and Peter S. Fosl
6. Scientific Thinking by Martin, Robert
7. Pseudoscience and Extraordinary Claims of the Paranormal : A Critical Thinker's Toolkit by Jonathan C. Smith
8. The Scientific Attitude: Defending Science from Denial, Fraud, and Pseudoscience by McIntyre, Lee
9. What Science Is and How It Really Works by James C. Zimring

4.3 Research Ethics References:

I am listing below a list of 20 books that I liked on this subject. The first set of books are basic and cover all the necessary material at an elementary level.

1. The Elements of Ethics for Professionals by Johnson, W. Brad, Ridley, Charles R.
2. The Student's Guide to Research Ethics by Oliver, Paul.
3. Research Ethics for Scientists: A Companion for Students by Stewart Jr., C. Neal
4. Ethics in Science: Ethical Misconduct in Scientific Research by D'Angelo, John G
5. Elements of Ethics for Physical Scientists by Greer, Sandra C.
6. Ethics of Scientific Research by Shrader-Frechette, Kristin.
7. The Ethics of Science: An Introduction by Resnik, David B.
8. The Elements of Mentoring by W. Brad Johnson

The next set of books are detailed case studies which are quite useful in making concrete some of the general advice given in the books above.

1. Scientific Misconduct Training Workbook by D'Angelo, John Gaetano
2. Scientific Integrity: Text and Cases in Responsible Conduct of Research by Macrina, Francis L
3. Engineering Ethics: Concepts and Cases by Pritchard, Michael, Harris Jr., Charles, Rabins, Michael J., James, Ray, Englehardt, Elaine
4. Betrayers of the Truth : Fraud and Deceit in the Halls of Science by Wade Nicholas, Broad William
5. Plastic Fantastic: How the Biggest Fraud in Physics Shook the Scientific World by Reich, Eugenie Samuel
6. The Ethical Chemist: Professionalism and Ethics in Science by Kovac, Jeffrey.
7. Science Fictions: How Fraud, Bias, Negligence, and Hype Undermine the Search for Truth by Stuart Ritchie
8. Research Ethics : Cases and Materials by Penslar, R L

The third set of books enquire deeply into what research ethics should be: they grapple with deeper philosophical issues which are brushed aside in the previous books.

1. Researching with Integrity: The Ethics of Academic Enquiry by Macfarlane, Bruce.
2. A New Approach to Research Ethics: Using Guided Dialogue to Strengthen Research Communities by Mustajoki, Henriikka, Mustajoki, Arto.
3. Scientific Integrity and Research Ethics: An Approach from the Ethos of Science by Koepsell, David.
4. Research Ethics: A Philosophical Guide to the Responsible Conduct of Research by Comstock, Gary.
5. Ethics and Science: An Introduction by Briggle, Adam, Mitcham, Carl.
6. An Introduction to Ethics by Deigh, John

Apart from these books, there is a growing variety of online resources on research ethics which can be accessed by an online search.

4.4 References on Research Communication:

The bibliography in this subsection is the longest covering various aspects of research communication. The quality among the texts vary widely and my favourites appear in the beginning.

On Scientific Writing : We will start with texts on writing that mostly focus on writing of research articles. Most contents are same across these books, but in some, they are *written* better.

1. Writing Science in Plain English by Greene, Anne
2. The Scientist‘s Guide to Writing by Heard, Stephen B.
3. Writing Science: How to Write Papers That Get Cited and Proposals That Get Funded by Schimel, Joshua
4. Science Research Writing For Non-native Speakers Of English by Glasman-Deal, Hilary
5. Becoming an Academic Writer: 50 Exercises for Paced, Productive, and Powerful Writing by Goodson, Patricia
6. Academic Writing for Graduate Students: Essential Tasks and Skills by Swales, John M., Feak, Christine B.
7. Mastering Academic Writing in the Sciences: A Step-by-Step Guide A Step-by-Step Guide by Aliotta, Marialuisa
8. How to Write and Publish a Scientific Paper by Gastel, Barbara, Day, Robert A.
9. Writing for Science Students by Boyle, Jennifer, Ramsay, Scott.
10. Detox Your Writing: Strategies for doctoral researchers by Thomson, Pat, Kamler, Barbara
11. Helping Doctoral Students Write: Pedagogies for supervision by Kamler, Barbara, Thomson, Pat
12. How to Write a Lot: A Practical Guide to Productive Academic Writing by Silvia, Paul J.
13. Professors as Writers by Boice, Robert
14. The Oxford Essential Guide to Writing by Kane, Thomas S.
15. The Craft of Scientific Writing by Alley, Michael
16. How to Write a Scientific Paper: An Academic Self-Help Guide for PhD Students by Saramaki, Jari
17. Scientific Writing for Students and Young Scientists by Isaac, Dr Alfred Orina
18. MLA Handbook for Writers of Research Papers
19. Scientific Writing: A Reader and Writer’s Guide by Lebrun Jean- Luc
20. Scientific Writing 2.0: A Reader and Writers Guide by Lebrun Jean - Luc

On Mathematical Writing: Writing of mathematics and proofs involve additional issues which are dealt within the following texts.

1. Mathematical Writing by Knuth, Donald E., Larrabee, Tracy, Roberts, Paul M.
2. Handbook of Writing for the Mathematical Sciences Higham, Nicholas J.
3. Writing Mathematics Well by Gillman, Leonard
4. How to Write Mathematics by N. E. Steenrod, P. R. Halmos, M. M. Schiffer, J. A. Dieudonné
5. Handbook of Typography for the Mathematical Sciences by Krantz, Steven George
6. Mathematical Publishing: A Guidebook by Krantz, Steven George
7. A Mathematician's Survival Guide : Graduate School and Early Career Development by Krantz, Steven George
8. A Mathematician Comes of Age
9. The Proof is in the Pudding: The Changing Nature of Mathematical Proof by Krantz, Steven George

On Science Communication: The following texts focus on the skills involved in science communication to a general audience.

1. Chicago Guide to Communicating Science by Montgomery, Scott L.
2. A Scientist's Guide to Talking with the Media: Practical Advice from the Union of Concerned Scientists by Hayes, Richard, Grossman, Daniel
3. The Craft of Science Writing: Selections from The Open Notebook by Carpenter, Siri
4. The Science Writers' Essay Handbook: How to Craft Compelling True Stories in Any Medium by Nijhuis, Michelle, Michelle Nijhuis
5. A Field Guide for Science Writers: The Official Guide of the National Association of Science Writers by Blum, Deborah, Knudson, Mary, Henig, Robin Marantz
6. The Science Writers' Handbook: Everything You Need to Know to Pitch, Publish, and Prosper in the Digital Age by Writers of SciLance
7. Getting to the Heart of Science Communication: A Guide to Effective Engagement by Kearns, Faith
8. Science Communication: A Practical Guide for Scientists by Bowater, Laura, Yeoman, Kay
9. Routledge Handbook of Public Communication of Science and Technology by Bucchi, Massimiano, Trench, Brian
10. Science in Translation by Olohan, Maeve, Salama-Carr, Myriam

On the History of Science Communication

If you are interested in how the modern forms of scientific communication came into being, I will recommend the following texts:

1. The Scientific Journal - Authorship and the Politics of Knowledge in the Nineteenth Century by Csiszar, Alex
2. Communicating Science: The Scientific Article from the 17th Century to the Present by Gross, Alan G, Harmon, Joseph E, Reidy
3. The Scientific Literature - A Guided Tour by Harmon, Joseph E, Gross, Alan G
4. Scientific Babel: The language of science from the fall of Latin to the rise of English by Gordin, Michael
5. The Scientific Voice by Montgomery
6. Scientific Authorship: Credit and Intellectual Property in Science edited by Mario Biagioli (Editor), Peter Galison (Editor)

On Style: Here are a set of books focused on style in writing. Some of them pertain to academic writing but the principle are often very general.

1. The Elements of Style by Strunk and White
2. Style: Lessons in Clarity and Grace by Williams and Bizup
3. The Sense of Style by Steven Pinker
4. On Writing Well by William Zinsser
5. Bird by Bird: Some Instructions on Writing and Life by Anne Lamott
6. Stylish Academic Writing by Sword, Helen
7. Air & Light & Time & Space - How Successful Academics Write by Sword, Helen

On Speaking and Rhetoric: We now come to a list of references on speaking and rhetoric. First is a list of texts focused especially on scientific talks/presentations:

1. A Handbook of Public Speaking for Scientists and Engineers by Kenny, Peter
2. Dazzle 'em with Style: Introduction to the Art of Oral Scientific Communication by Anholt, Robert R. H.
3. Sell Your Research : Public Speaking for Scientists by Youknovsky, Alexia, Bowers, James.
4. The Craft of Scientific Presentations by Michael Alley `https://link.springer.com/book/10.1007/978-1-4419-8279-7`
5. Presentation Skills for Scientists: A Practical Guide by Zanders, Edward, MacLeod, Lindsay.

On the more general subject of public speaking, I found the following texts an interesting read :

1. Public Speaking Basics by Griffin, Michael A.
2. The Art of Public Speaking by Lucas, Stephen
3. Your Guide to Public Speaking by Hennessey, Amanda
4. The Quick and Easy Way to Effective Speaking by Dale Carnegie
5. Develop Self-Confidence, Improve Public Speaking by Dale Carnegie
6. I Have Something to Say: Mastering the Art of Public Speaking in an Age of Disconnection by Bowe, John

Here are a list of books focused on rhetoric (i.e., the art of speech and persuasion).

1. Rhetoric: A Very Short Introduction by Richard Toye
2. Classical English Rhetoric by Farnsworth, Ward, David R. Godine
3. You Talkin' To Me ? : Rhetoric from Aristotle to Trump and Beyond by Leith, Sam,
4. The Elements of Rhetoric by Topping, Ryan N. S.
5. Reading Rhetorically by Bean, John, Chappell, Virginia, Gillam, Alice, Pearson
6. A Rhetoric for Writing Teachers by Erika Lindemann
7. The Art of Rhetoric by Aristotle

That is all for now.