# Popular Science Writing: Why and How

By

Biman Basu

Former Editor, ***Science Reporter***

**bimanbasu@gmail.com**

# Taking Research to People

- Research is the backbone of progress of science.
- Every year, thousands of research papers are published in journals across the world.
- Research papers are primarily addressed to others researchers in the field and peers.
- They are mostly beyond the understanding of the common man.
- This situation can be changed by encouraging researchers to write in popular language.

# What is Science Communication?

- It is the dissemination of scientific and technological knowledge among a wide range of audiences including non-scientists.
- Generally it refers to public communication of science through any media - print, audio, audio-visual, or digital - presenting S&T-related topics to non-experts.

# Why do We Need Science Communication?

- From the Copernican Revolution to the Theory of Relativity and discovery of the double-helix structure of DNA, effective science communication has historically changed and will continue to change the world.
- Effective communication of science in a popular language is probably as important a skill as learning how to do science for the benefit of society.

# Kinds of Science Communication

- Scholarly science communication
- Semi-popular science communication
- Popular science communication
- Science communication through literary writings (Science Fiction)

# What Is Popular Science Writing?

- Popular science writing is different from technical writing or writing a research paper, which is primarily aimed at fellow scientists and peers.
- It is more broad-ranging and avoids use of equations, technical terms, and formulae.
- It is the interpretation of scientific research in a simple, jargon-free language, comprehensible to the layman.

# Popular Science Writing-2

- It is the interpretation of science intended for a general audience, rather than for other experts in the same field.
- It is a methodology to inform and convince non-scientists (sometimes along with scientists in other fields) of the significance of new developments and conclusions in any field of S&T and their possible impact.

# Popular Science for Whom?

- General public
- Decision/Policy makers
- Scientists/Professionals
- Children

# Objectives of Popular Science

- To make the general public aware of new developments in science and technology.
- To help the common citizen understand the impact of developments in S&T on their lives.
- To help develop a scientific and rational attitude of mind and take informed decisions.
- To kindle an interest in doing science, especially in students/young people.
- To make policy makers aware of good research and facilitate funding.

# It Helps In Comprehending Changes

- The changes we see today around us brought about by rapid developments in S&T are often mind-boggling.
- Often people, especially those not well versed with science, are confounded by these extremely rapid and complex changes.
- Popular science communication can help them comprehend the changes.

# It Helps In Decision Making

- Popular science writing helps inform decision makers about critical issues in areas of science involving ethics and policy questions, e.g., foetal sex determination, GM food, nuclear energy, etc.
- It helps in taking decisions in respect of issues involving modern scientific techniques, e.g., in the use DNA fingerprinting in deciding paternity or criminal acts.

# To The Aid Of Scientists

- Popular science writings help scientists from one discipline to understand the research in other disciplines and often leads to collaboration and interdisciplinary research.
- It often helps attract more public and private support and funds for research.
- Also acts as a bridge between scientists and the general public.

# Who Can Popularise Science?

- Practising scientists, if they have the communication skill.
- Individuals with a degree or some training in science and a flair for writing.
- Journalists with interest and ability to understand science.

# Scientists as Science Popularisers

- Scientists are the most qualified to write about their own work.
- It is important for people to understand the scientific issues, and that's where scientists as science communicators can be more effective.
- But there is a certain elitism among working scientists who consider a popular science writer not as competent or good a scientist as he or she could be otherwise.

# Training Scientists in Popular Science

- Unfortunately, in the past not much consideration was given to training scientists to communicate, except with other scientists.
- And much of that is full of "the technical terminology" or jargon, which can make what scientists say difficult even for scientists in other disciplines to understand.
- So, there is urgent need for training scientists to learn to communicate in a language that non-scientists can understand, and that's what AWSAR is all about.

# Popular Science Writing Is An Art

- Writing a research paper generally follows a fixed format.
- The IMRAD structure - Introduction, Methods and Materials, Results, and Discussion.
- Research papers also have to follow the style guides of particular journals.
- Popular science writing is more informal; it need not follow any rigid structure.
- The writer has full control over the format and style of presentation.

# Role Of The Popular Science Writer

- Primary task of a scientist  who wants to write popular science is to first make clear the research he or she is engaged in, in layman's language.
- The next task is to accurately and objectively translate the often complex accounts of his or her research into simple non-technical language.

# Medium of Popular Science Communication

- Print
- Audio/Audiovisual
- Electronic/Digital
- Multimedia

# Print Media

| | | |
|---|---|---|
| • **Dailies** | Only cursory treatment possible | Of ephemeral value |
| • **Periodicals** | More detailed treatment possible | Of intermediate value |
| • **Books** | Most comprehensive treatment possible | Of lasting value |

# Electronic Media

- Radio
- Television
- Internet/Blogs
- CD ROM Multimedia

# Science Blogs

- Communicating science through blogging is gaining popularity by the day.
- Number of blogs written by professional research scientists is growing every day.
- Blogs can significantly increase readership of science papers.
- An attractive headline, good image and the first paragraph is crucial for a blogpost to be effective.

# The Structure Of A Popular Science Article

- While scientific papers begin with Introduction and Materials and end with the Results and Conclusions, popular science articles often turn it upside down and start with the results.
- Sometimes it is preferable to structure the text like a crime novel or a mystery, where you start with a pressing question and present the results later.
- It always pays to give a concrete example to explain something abstract or general.

# Language of Popular Science

- Simplicity
- Clarity of ideas
- Avoidance of jargon
- Use of suitable metaphors and analogies
- Relating it to everyday experience
- Avoidance of information overload

# Example of Simplicity

**Lactose is a large molecule and cannot pass through the wall of the small intestine into the bloodstream. It is usually broken down in the body into glucose and galactose by an enzyme called lactase. Normally the digestive systems of infants and children produce plenty of lactase, but the production decreases with growing age. When the production drops below a certain minimum amount, the body is not able to break down lactose. The deficiency or lack of lactase can cause severe digestive problems – a condition known as 'lactose intolerance'.**

# Example of Simplicity-2

**Space has attracted humans for ages. Early sky watchers had tried to explain the goings on in the sky in an effort to understand the universe. Modern day astronomers continue the process to explore it more and more. This tireless effort of astronomers has succeeded in unveiling many mysteries of universe, but at the same time these successes have raised many new questions yet to be explained.**

# Example of Clarity of Ideas

**Stem cells are the building blocks of the human blood and immune systems. They form the white blood cells that fight infection, red blood cells that carry oxygen, and platelets that promote healing. Stem cells are also present in bone marrow and they generate new cells throughout life.**

**In the past few years, significant progress has been seen in the use of stem cells for therapeutic use to treat a wide variety of medical problems ranging from blindness and paralysis to cardiac disease and liver cirrhosis.**

# The Beginning

- The beginning of a popular science article needs to be tailored to attract the prospective reader to read the article.
- It may lead with an anecdote or an event to guide the reader to the specific research done by the writer.
- Relevant figures/numbers/statistics may be used to drive a point.

# Example-1 (Original Paper)

**We report a bioinspired design for tough adhesives (TAs) consisting of two layers: an adhesive surface and a dissipative matrix. The design is inspired by a defensive mucus secreted by slugs (*Arion subfuscus*) that strongly adheres to wet surfaces. This slug adhesive consists of a tough matrix with interpenetrating positively charged proteins. Our TAs are made up of two layers: (i) an adhesive surface containing an interpenetrating positively charged polymer and (ii) a dissipative matrix. The adhesive surface can bond to the substrate through electrostatic interactions, covalent bonds, and physical penetration, whereas the matrix dissipates energy through hysteresis under deformation. (*Science*, 28 July 2017)**

# Example-1 (Popular Write-up)

**Can you stick Band Aid on wet skin or stick something with glue on a wet surface? The answer is of course, an emphatic 'No'. It is well known that to stick anything to a surface it has to be clean and dry. But now scientists have come out with a new, flexible adhesive material inspired by the glue secreted by slugs that sticks to biological tissues (even when wet) without causing toxicity. The inspiration for the glue came from the dusky slug (*Arion subfuscus*) found in North America and Western Europe. To mimic this design, the researchers created a matrix from cross-linked polymers, polyacrylamide, and alginate and then coated it with chitosan (made by treating the shells of shrimps and clams with alkali).**

# Example-2 (Original Paper)

**A minimal extension of the standard model (SM) with a single new mass scale and providing a complete and consistent picture of particle physics and cosmology up to the Planck scale is presented. We add to the SM three right-handed SM-singlet neutrinos, a new vector like colour triplet fermion, and a complex SM-singlet scalar σ that stabilises the Higgs potential and whose vacuum expectation value at $\sim 10^{11}$ GeV breaks lepton number and a Peccei-Quinn symmetry simultaneously. Primordial inflation is produced by a combination of σ (non-minimally coupled to the scalar curvature) and the SM Higgs boson. Baryogenesis proceeds via thermal leptogenesis. At low energies, the model reduces to the SM, augmented by seesaw-generated neutrino masses, plus the axion, which solves the strong CP problem and accounts for the dark matter in the universe. (*Physical Review Letters*, 15 February 2017)**

# Example-2 (Popular Write-up)

**Dubbed SMASH, for "Standard Model Axion Seesaw Higgs" model, the theory was developed in an attempt to unify multiple different theories to solve five of the biggest problems in physics: dark matter, cosmic inflation, the strong CP problem, neutrino oscillations, and the imbalance of matter and antimatter. The SMASH theory adds a total of six new particles to the Standard Model including a so-called 'axion' and the heavy 'rho' particle. According to the researchers, the axion is a candidate for dark matter; and the rho particle is a bit like the Higgs boson; it gives mass to neutrinos. In addition, the new model provides explanations as to why our universe contains so much more matter than antimatter.**

# Avoidance of Technical Terms

**The tests for leukaemia are based on karyotyping. For this test, marrow is aspirated from the hip bone under local anaesthesia and subjected to culture. After a few days, the chromosomes are studied to look for Philadelphia chromosome.**

**Modified:**
**The tests for leukaemia are based on the study of chromosomes. For this test, marrow is removed by suction from the hip bone under local anaesthesia and subjected to culture. After a few days, the chromosomes are studied to look for Philadelphia chromosome.**

# Use of Analogy

**Here is a simple analogy to explain how particles get mass through Higgs mechanism.**

**A room full of physicists quietly chattering is like space filled only with the Higgs field. When a well-known scientist walks in, he creates a disturbance as he moves across the room, attracting a cluster of admirers with each step. This slows down his movement; in other words he acquires mass, just like a particle moving through the Higgs field. Stronger the interaction greater would be the resistance and larger the mass.**

# Avoidance of Information Overload

***Aloe vera*** **has specific pharmacological effects in human health as anti-inflammatory, anti-allergic, antioxidant, antimicrobial, antispasmodic, chemopreventive, hepato-protective, hypolipidemic, neuroprotective, hypotensive, anti-ageing, antidiabetic, protection of DNA damage, cancer and heart diseases, induce apoptosis, diuretic, CNS stimulant, analgesic, immuno-modulator and carminative, and many other therapeutic effects. (*International Journal of Green Pharmacy*, Jan-Mar 2018)**

# Avoidance of Information Overload-2

## Redrafted paragraph

***Aloe vera*** **has specific pharmacological effects in human health. It contains compounds that have anti-inflammatory, anti-allergic, antioxidant, antimicrobial, antispasmodic, anti-ageing, anti-diabetic, and many other therapeutic effects.**

# Elaborate Unexplained Terms

**According to Codex Alimentarius (FAO/WHO, 1999), 'organic agriculture is a holistic production management system which promotes and enhances……'**

**Modified:**
**According to Codex Alimentarius (FAO/WHO, 1999) - a collection of internationally recognised standards, codes of practice, guidelines and other recommendations relating to foods, food production and food safety - 'organic agriculture is a holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles and soil biological activity.'**

# Elaborate Unexplained Terms

**These may include joint pains, muscle weakness, fluid retention, carpal tunnel syndrome, impaired glucose regulation leading to diabetes, hyperlipidemia, and cardiomyopathy.**

**Modified:**
**These may include joint pains, muscle weakness, fluid retention, a disorder of the hand characterised by numbness, tingling, pain, and weakness, known as carpal tunnel syndrome, impaired glucose regulation leading to diabetes, presence of excess fats in the blood, and disorder of the heart muscle.**

# Use Simple Words

- Always prefer simple words rather than complex words, e.g.,

**Rare** rather than **infrequent**

**End** rather than **terminate**

**Close** rather than **proximal**

**Since** rather than **in view of the fact that**

**Consider** rather than **take into consideration**

**Now** rather than **at this point in time**

**If** rather than **in the event that**

# Points to Remember

- While referring to scientists, always mention their affiliations and place names.
- Always cross-check all references mentioned in the article from other sources as far as possible.
- Always spell out all abbreviations at least once in the popular write-up.

# The Art of Writing

- Be focussed and develop the story logically.
- Very all facts.
- Don’t cram too many details.
- Try to sustain interest.
- Bring out social implications, if any.
- Bring out future potentials where relevant.

# The Art of Writing-2

- Pay attention to grammar.
- Use UK/Indian English spellings, not American spellings.
- Use only metric units.
- Names should be fully identified including nationality if foreigner.
- Locations (towns, cities) should be fully identified by state if Indian, or by country if foreign.

# Submitting For Publication

- Take utmost care to ensure that the script is error-free.
- Pages should be numbered.
- Figures, photographs, graphs and tables should not be inserted into the text and should be submitted separately.
- Figure captions should be should be properly listed and submitted separately.

# Things to Avoid

- Misleading heading/title
- Use of non-metric units
- Unexplained terms/acronyms/ abbreviations
- Long, complex sentences
- Opinionated inferences/conclusions

# In Brief

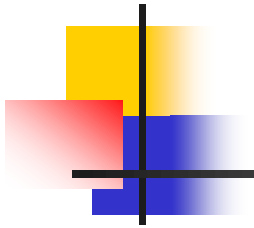
- Adapt the content to the level of general knowledge of an educated adult who is not a scientist or an engineer.
- It may be easier if you keep a specific target audience in mind when you are writing – children, educated adults, general public, etc.
- Remember, the popular science writer has the complete freedom to express his/her thoughts in whatever way he/she feels fit.

# Ethics of Popular Science

- Avoiding false and exaggerated claims
- Acknowledging the source where relevant
- Presenting both sides of a debatable issue
- Refraining from plagiarism

# In Conclusion

Writing good popular science is a challenging task that requires not only a thorough understanding of the subject being written about, but also an ability to communicate science in a simple language without sacrificing or diluting the scientific content.



# Thank You