SP1541
Exploring Science Communication through Popular Science

Post Lesson Students' Notes
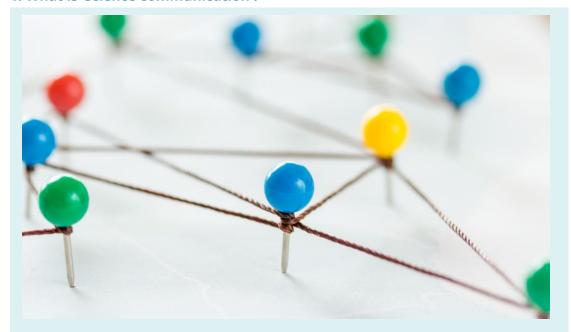Week 2

AY 2022/2023 Semester 1

1. What is 'science communication'?

The Office of Science and Technology and Welcome Trust (2000) defined science communication in the 2000 report "Science and the public: A review of science communication and public attitudes to science in Britain" as a term that "encompasses communication between:

- groups within the scientific community, including those in academia and industry;
- the scientific community and the media;
- the scientific community and the public;
- the scientific community and government, or others in positions of power and/or authority;
- the scientific community and government, or others who influence policy;
- industry and the public;
- the media (including museums and science centres) and the public; and
- the government and the public."

Another term which is often used in relation with science communication is **Public Engagement with Science** (PES). McCallie et al. (2009) described PES as a field which involves scientists working with the public to allow people with varied scientific backgrounds and expertise to contribute and communicate their perspectives, ideas, and knowledge in relation to science topics and science-related issues.

Kappel and Holmen (2019) identify two paradigms of science communication: **Dissemination** and **Public Participation** paradigms. The former focuses on a one-way transmission of scientific information from experts to the public; the latter emphasises on a two-way or multiple-way communication between the public, experts and decision-makers.

2. Why is science communication important?

Traditional scientific training rarely prepares scientists to become effective communicators especially outside their academia circles. While scientists are mainly interested in how their findings fit into or extend the existing body of research, the public is eager to know how these findings may have an impact on their lives (Jucan & Jucan, 2014).

Kappel and Holmen (2019) review the science communication literature and propose a **conceptual framework of science communication aims:**
1. Improving the population's beliefs about science;
2. Generating social acceptance;
3. Generating public epistemic and moral trust;
4. Collecting citizens' input about acceptable/worthwhile research aims and applications of science;
5. Generating political support for science;
6. Collecting and making use of local knowledge;
7. Making use of distributed knowledge or cognitive resources to be found in the citizenry; and
8. Enhancing the democratic legitimacy of funding, governance and application of science or specific segments of science.

These aims can be used to guide science communication efforts by scientists and science communicators.

3. What is 'popular science writing'?

Popular science is a genre related to science intended for a general, non-specialist audience.

Popular science is not limited to just books, but it can also include periodicals (e.g. *Scientific American, American Scientist*, and *Nature*), TV channels (e.g. *National Geographic,* and *Discovery*), documentaries, online news stories (e.g. *Science Daily* and *The Guardian*'s Science Section) and blogs.

According to Perrault (2013), popular science writing serves two purposes:

1. informs readers about scientific findings; and
2. help readers (e.g. scientists, non-scientists, scientists working outside their reads of expertise) to understand how a given area of research affects and is affected by other social institutions.

In this course, you will be reading chapters from five popular science books amongst other selections in the form of science news articles and science talks. These five books have been specially selected by your professors in the various departments of the Faculty of Science.

4. What are the five selected book chapters about?

Life Science: Evolutionary biology

The Selfish Gene by Richard Dawkins

"The million copy international bestseller, critically acclaimed and translated into over 25 languages. As influential today as when it was first published, The Selfish Gene has become a **classic exposition of evolutionary thought**. Professor Dawkins articulates **a gene's eye view of evolution** - a view giving centre stage to these persistent units of information, and in which organisms can be seen as vehicles for their replication. This imaginative, powerful, and stylistically brilliant work not only brought the insights of Neo-Darwinism to a wide audience, but galvanized the biology community, generating much debate and stimulating whole new areas of research. Forty years later, its insights remain as relevant today as on the day it was published" (National Library Board, 2022).

Book Reviews

Radford, T. (2012, August 31). The Selfish Gene by Richard Dawkins – book review [Book Review]. The Guardian. https://www.theguardian.com/science/2012/aug/31/the-selfish-gene-richard-dawkins-review

Reeve, E. (2009, April 14). The Selfish Gene. By Richard Dawkins [Book Review]. *Genetics Research, 55*(1), 63-65. https://www.cambridge.org/core/journals/genetics-research/article/selfish-gene-by-richard-dawkins-new-revised-edition-oxford-university-press-1989-352-pages-cloth-1750-paper-595-isbn-0-19-217773-0-19286092-5/19194E62AB941F71EF0730B7131E2D6F#article

Mathematics: Prime numbers

The Music of The Primes by Marcus du Sautoy

"The ebook of the critically acclaimed popular science book by a writer who is fast becoming a celebrity mathematician. **Prime numbers are the very atoms of arithmetic.** They also embody one of the most tantalising enigmas in the pursuit of human knowledge. **How can one predict when the next prime number will occur? Is there a formula which could generate primes?** These apparently simple questions have confounded mathematicians ever since the Ancient Greeks. In 1859, the brilliant German mathematician Bernard Riemann put forward an idea which finally seemed to reveal a magical harmony at work in the numerical landscape. The promise that these eternal, unchanging numbers would finally reveal their secret thrilled mathematicians around the world. Yet Riemann, a hypochondriac and a troubled perfectionist, never publicly provided a proof for his hypothesis and his housekeeper burnt all his personal papers on his death. Whoever cracks Riemann's hypothesis will go down in history, for it has implications far beyond mathematics. **In business, it is the lynchpin for security and e-commerce. In science, it has critical ramifications in Quantum Mechanics, Chaos Theory, and the future of computing.** Pioneers in each of these fields are racing to crack the code and a prize of $1 million has been offered to the winner. As yet, it remains unsolved. In this breathtaking book, mathematician Marcus du Sautoy tells the story of the eccentric and brilliant men who have struggled to solve one of the biggest mysteries in science. It is a story of strange journeys, last-minute escapes from death and the unquenchable thirst for knowledge. Above all, it is a moving and awe-inspiring evocation of the mathematician's world and the beauties and mysteries it contains." (National Library Board, 2022)

Chemistry: Molecules

Napoleon's Buttons by Penny Le Couteur and Jay Burreson

"*Napoleon's Buttons* is the fascinating account of seventeen groups of molecules that have greatly influenced the course of history. These molecules provided the impetus for early exploration, and made possible the voyages of discovery that ensued. **The molecules resulted in grand feats of engineering and spurred advances in medicine and law; they determined what we now eat, drink, and wear.** A change as small as the position of an atom can lead to enormous alterations in the properties of a substance-which, in turn, can result in great historical shifts. With lively prose and an eye for colourful and unusual details, Le Couteur and Burreson offer a novel way to understand the shaping of civilization and the workings of our contemporary world." (National Library Board, 2022).

Statistics: Probability

Statistics: A Guide to the Unknown by Roxy Peck, George Casella, George W. Cobb, Roger Hoerl, Deborah Nolan , Robert Starbuck and Hal Stern

"This collection of intriguing essays describes important **applications of statistics and probability** in many fields. Instead of teaching methods, the essays illustrate past accomplishments and current uses of statistics and probability. Surveys, questionnaires, experiments, and observational studies are also presented to help the student better understand the importance of the influence of statistics on each topic covered within the separate essays. The overarching goal of STATISTICS: A GUIDE TO THE UNKNOWN is to demonstrate the **wide use and importance of statistics through an integrated set of case studies that are readable, interesting, and meaningful to the general public**." (Google Books, 2022).

Book Review

Hayden, R.W. (2006). A Review of "Statistics: A guide to the unknown" [Book Review]. Journal of Biopharmaceutical Statistics, 16(4), pp.577-578.
https://doi.org/10.1080/10543400600721620

Physics: Gravity, relativity, and black holes

A Brief History of Time by Stephen Hawking

"A landmark volume in science writing by one of the great minds of our time, Stephen Hawking's book explores such profound questions as: **How did the universe begin—and what made its start possible? Does time always flow forward? Is the universe unending—or are there boundaries? Are there other dimensions in space? What will happen when it all ends?**

Told in language we all can understand, *A Brief History of Time* plunges into the exotic realms of black holes and quarks, of antimatter and "arrows of time," of the big bang and a bigger God—where the possibilities are wondrous and unexpected. With exciting images and profound imagination, Stephen Hawking brings us closer to the ultimate secrets at the very heart of creation." (National Library Board, 2022).

Book Review
Bartusiak, N. (1988, April 3). A brief history of time from the big bang to black holes [Book Review].
https://archive.nytimes.com/www.nytimes.com/books/98/12/06/specials/hawking-time.html?module=inline

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Google Books (2022). Statistics: A guide to the unknown [Description]. https://books.google.com.sg/books/about/Statistics.html?id=28dQNQAACAAJ&source=kp_book_description&redir_esc=y

Kappel, K. & Holmen, S. J. (2019). Why science communication and does it work? A taxonomy of science communication aims and a survey of the empirical evidence. *Frontier Communication, 4*(55). https://doi.org/10.3389/fcomm.2019.00055

Jucan, M. S., & Jucan, C. N. (2014). The Power of Science Communication. *Procedia-Social and Behavioral Sciences*, *149*, 461-466.

McCallie, E., Bell, L., Lohwater, T., Falk, J. H., Lehr, J. L., Lewenstein, B. V., Needham, C., Wiehe, B. (2009). *Many experts, many audiences: public engagement with science and information science education*. Washington: Centre for Advancement of Informal Science Education.

National Library Board (2022). A brief history of time [Description]. https://nlb.overdrive.com/media/567258

National Library Board (2022). *Napoleon's Buttons: How 17 molecules changed history* [Description]. https://nlb.overdrive.com/media/901364

National Library Board (2022). *The music of the primes: searching to solve the greatest mystery in mathematics* [Description]. https://nlb.overdrive.com/media/901364

National Library Board (2022). *The selfish gene/ Richard Dawkins* [Description]. https://nlb.overdrive.com/media/4979572

Office of Science and Technology and Wellcome Trust (2000). Science and the public: A review of science communication and public attitudes to science in Britain. http://www.wellcome.ac.uk/stellent/groups/corporatesite/@msh_peda/documents/web_document/wtd003419.pdf

Perrault, S. (2013). Communicating popular science: from deficit to democracy. London: Palgrave Macmillan UK.

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