United Nations
Educational, Scientific and
Cultural Organization

Broadcasting Science

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AIBD

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> **We live in a society exquisitely dependent on science and technology, in which hardly anyone knows anything about science and technology.**
>
> *Carl Sagan*

Preface

In spite of the fact that science and technology have great bearing on the day-to-day lives of people today, broadcasters do not seem to adequately cover science and technology. In order to build the capacity of broadcasters to report and cover scientific topics, AIBD proposed to produce a resource and training kit. We thank IPDC-UNESCO for supporting this idea.

This book is the core part of the kit. It contains two parts. Part I is a general introduction of science to broadcasters. Part II deals with use of scientific information in broadcasting.

The expert advice given at the beginning by Dr Martin Hadlow, Dr Madeline M Suva, Mr Nalaka Gunawardene, and Mr Killugudi S Jayaraman provided the structure for the book. The effort undertaken involves a larger number of people than the authors. Ms. Sarah Lee, intern, AIBD and Ms. Lutfa Ahmed, Programme Manager, AIBD contributed to research and gave extensive feedback on this book. Expert comments from Dr Parvez Imam led to many changes from the earlier drafts. The feedback from many TV and radio producers led to reworking the text in many sections of the book. Ms. Gita Madhu and Ms Mimmy Jain contributed to making many improvements in language and punctuation.

The attempt has been to keep the book as short as possible while being as useful as possible to broadcasters.

The process so far, which took more than 2 years, is given at the end. It does not end here. Your feedback will add to the usefulness and relevance to the kit.

Javad Mottaghi

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INTRODUCTION

This book is for broadcasters of all flavours, colours and tastes. Whether you are reporting politics, business, sports, fashion or any other beat, which appear far removed from science, you will benefit from having a basic awareness of science.

Science is not all about faraway galaxies or subatomic particles. It is about explanations about natural phenomena, including our society. So, politics, religion or our thought processes or imagination are not beyond the scope of scientific investigation.

For example, if you are reporting a local conflict, there are enough scientific studies on aggression and violence that may throw light on the situation.

You can give a new spin on sports if you have enough understanding about sports science and the pharmacology of performance enhancing drugs.

Business cycles are specific examples of quasi-periodic phenomena and your reporting would bear a fresh perspective if you could dig deep into non-linear dynamics.

How can you report on a crime without understanding the basics of forensic science?

This book will help you to improve your programme even if you are a DJ presenting songs at a local radio station.

Of course, if you want to specialize in science reporting, you might want more awareness of science than what a producer of a cookery show would need. We have something for you too in this book.

Part 1

Science for Broadcasters

1

What is science?

There are two ways of looking at science:

1. Science as a subject that is taught in schools and colleges – as a set of "facts", well established through observations and experiments.

2. Science as what scientists do.

Science, as is taught in schools and colleges may be perceived as boring, difficult and complex, or interesting and even beautiful, depending on how it is taught[1]. If the falling rates of enrolment in science streams in colleges is a sign, it would appear that most people end up thinking science to be difficult, if not boring.

> **Science is a way of thinking much more than it is a body of knowledge...**
>
> *Carl Sagan*

Quite often, textbook science dehumanizes science.[2] The agonies and ecstasies in the path to discovery or invention are not discussed at all. Even mentions of the names of scientists are limited to the most outstanding ones or are embedded in the names of laws or theories.

If we look at science as what scientists do, we find that science is full of human emotions.[3] Behind the passion of a scientist for a topic or subject are

1. See Sylvia Ceyer's lecture on Atomic Theory, available at http://academicearth.org/lectures/atomic-theory-matter-a for an example of how abstract topics can be made very interesting by adding the human component of science.

2. There are some exceptions. See, for instance, the Berkeley physics course, *Physics for Future Presidents*, by Richard Muller and Bob Jacobsen (http://muller.lbl.gov/teaching/Physics10/PffP.html). Watch the videos. An attempt to rehumanize science can be seen in Leon Cooper's *An Introduction to the Meaning and Structure of Physics*, Harper and Row, 1968.

3. For inspired and passionate talks on scientific topics by renowned scientists, see TED.org.

the events and situations of his life and the disappointments and delights he experiences during his investigations and experiments.

The path to discoveries in science and inventions/innovations in technology are well hidden in the manner in which scientists and technologists report their discoveries/inventions/innovations and in the way science is taught in schools and colleges. This is partly because of the norms and standards that have evolved over the last few centuries.

Broadcasting, however, has a different set of norms and standards. It is possible to change the way people look at science through broadcasting. Through broadcasting science can be made interesting and wonderful. Broadcasting can thus rekindle the spirit of inquiry and innovation in the minds of people. The critical attitude inherent in science could even help reduce the impact of religious, political and commercial propaganda.

Questioning: Shared feature of scientists and broadcasters

In order for science to progress, there has to be a question, a doubt or a query about a phenomenon.

Media professionals also ask questions – what, why, how, when, where, who – the five Ws and H. But unlike media professionals, scientists focus on "what, why and how" more than on "who, when and where".

> **Judge others by their questions rather than by their answers.**
>
> *Voltaire*

Formulating questions well and clearly is a major part of success in finding answers in science. Broadcasters need to master the art of questioning to get good bytes from interviewees.

There are certain strengths and weaknesses in each type of question. Here we will explore the characteristics of the five Ws and H.

Characteristics of questions:

1. What?

"What" is the first question that we learn to ask. A child carried around by an adult points at things and the adult names them for him. Soon, the child learns that every object has a name.

The corollary – that every noun has a corresponding object – is also unconsciously deduced. Though this deduction is not valid logically, it appears sound psychologically and it leads to much confusion in later life.

Moreover, the word that is given as an answer to the question "what" satisfies the curiosity of the child. The word puts a veil on the phenomenon. The phenomenon that seems to dance and is hot to touch is "fire". But the understanding of the phenomenon does not improve unless another "what" is asked. Again, other words like "flame" could be added to the vocabulary without improving understanding. What indeed is a flame or a fire? Have not the answers of the adult hidden the phenomenon of fire by using the word fire? The chemical reactions that liberate heat and the molecules of volatile gases that are excited to emit light are not about nouns, but about verbs. There is a lot of activity in a fire, but all that is obscured by the adult answer.

Given this understanding, we need to overcome the limitations of the habits that we have acquired during childhood and not be satisfied with the initial answers to "what". We have to learn to question the answers to get to the real understanding of phenomena.

2. Why?

"Why" is the second question that the child learns to ask. "Why did you climb the ladder?" asks the mother. To get to the cookie, of course. The child feels guilty, but learns to ask the question "why". To the utter irritation of adults, the child asks "why". And by this time, the child has learnt to question the answer.

"Why does the dog bark?"

"Because it has seen a stranger"

"Why does the dog bark at strangers?"….

The continuous stream of "whys", one on top of another, ultimately makes adults angry and the child is admonished: "Not one more why, or else…" The threat does the trick most of the time. The child learns not to ask any more questions. And the adults feel safe, hiding their ignorance and incapacity to answer.

One who asks a question is a fool for five minutes; one who does not ask a question remains a fool forever.

Chinese proverb

"Why" is a question that presupposes a conscious and sentient being with motivations, goals and intentions. Why did he go to the shopping mall? To buy a pinstripe shirt. Why a pinstripe shirt? Because he wanted to go for an important meeting. Why? That meeting will be very useful in building up his career… To answer every "why", we go into the future, clarifying wants, needs, desires, goals, aspirations, motivations or intentions. Inanimate objects cannot do this. So, we should not be asking the question "why" about things that do not have a conscious choice. Most natural phenomena do not have intentions. They are moved by the past. We, however, are moved by the future also. This distinction is not clear to children and to most adults. Hence, adults cannot redirect the questions of children and often feel threatened by the incessant stream of "why" questions. Soon they stop the curiosity of children from blossoming into the next stage.

3. How?

Why is the sky blue? Why do plants have flowers?

The question "why" is powerful enough to make people investigate and get answers.

However, when you examine the acceptable answers to such questions, you will find that you are really answering questions like "How is it that the sky appears blue to us?" and "How have plants evolved to grow flowers on them?"

You can tell whether a man is clever by his answers. You can tell whether a man is wise by his questions.

Naguib Mahfouz

The sky does not want to be blue nor do plants intend to attract insects.

If adults knew how to redirect children's questions from why to how, perhaps, we would have more scientifically oriented people. The question "how" is what most scientists – except psychologists and sociologists – are really concerned with, though they may be pursuing the answer to a repressed and motivating "why".

4. Who, when and where?

Science is not generally concerned with "who, when and where".[4] As we shall see later in this book, information about scientists, the time of their discoveries, their workplaces and dwelling places are slowly eliminated in building the edifice of science. Perhaps, this is one of the reasons why people find science boring and dehumanizing.

The media, however, generates and sustains interest by emphasizing "who, when and where". These are the key questions that broadcasters can use to generate interest and to tell stories that interest people. We need to dig into history to bring to life the dry scientific understanding of phenomena.

The questions, "who, when and where", go together.

"Who was Cleopatra?"

"My friend's cat."

The art and science of asking questions is the source of all knowledge.

Thomas Berger

Well, if you were looking for another answer, you should have asked who was Cleopatra in 1st century BC Egypt and you would have got a long answer about the life and loves of a beautiful queen.

4. There are exceptions: Questions such as "When did this universe come into being?", "When did life originate on this planet?", "When did humans come to exist?", "Where did the first humans exist?", etc., are a part of scientific inquiry.

2

How do scientists work?

Scientists pursuing different disciplines work in different ways. But there are some elements that are common to all disciplines.

> **Science is facts; just as houses are made of stones, so is science made of facts; but a pile of stones is not a house and a collection of facts is not necessarily science.**
>
> *Henri Poincare*

Questioning

The questions may relate to causes and/or correlations. If it is a question of correlation, then it leads to data collection that establishes the correlation (for example, smoking and cancer).

Quite often, science goes beyond mere data collection, especially when seeking causes for events/phenomena. Though causes may quite often throw up a correlation, correlation does not necessarily mean cause.

Standing on giant shoulders

To seek answers to their questions, scientists may read up existing literature (scientific reports) on the topic. Quite often, somebody else has already answered the question. That would reduce the burden of investigation to merely reaffirming the answer or to questioning the answer.

Hypothesis

If there are no satisfactory answers to be found in the works of other scientists, the scientist who asked the question – or his colleague – may guess an answer. This is a hypothetical answer.

Testing the hypothesis

The hypothesis should answer the question satisfactorily. It should not create logical contradictions to other accepted facts.[5] It should also be formulated

5. Sometimes, the hypothesis may contradict accepted facts and yet withstand rigorous testing by experimentation. Then there is potential for a paradigm change. See T S Kuhn's *Structure of Scientific Revolutions*, University of Chicago Press, 1962.

in a way that can be put to test. Experiments are devised and carried out to corroborate the hypothesis.[6]

The general view of experiments is that they "prove" the hypothesis. But philosophers of science have pointed out that this view has severe limitations. People will see only what they want to see. And scientists are also people who have selective perception. Biased perceptions can lead to selective results that are in tune with the hypothesis.[7]

I think that only daring speculation can lead us further and not accumulation of facts. Things should be made as simple as possible, but not any simpler.

Albert Einstein

Other scientists may criticize the hypothesis and try and point out the logical contradictions in it. They may also do experiments to show that the hypothesis or its logical outcomes are false.[8]

But in any case, if the experiment corroborates the hypothesis, it becomes stronger.

Quite often, an alternative hypothesis with experimental corroborations may also come up.

The problem would then be which hypothesis is stronger or better? Scientists may take sides based on the simplicity of the hypothesis and the explanatory power. If a hypothesis predicts a new phenomenon that has not been observed earlier and it is experimentally corroborated, it would add value to the hypothesis.

Science thus inches slowly towards the truth, but scientists cannot say when they till reach it. But when a hypothesis is proven by experiments, it is seen as a real step forward.

There are theoretical scientists who never do any experiments. But ultimately, their work also gets credibility when experimental evidence corroborates their ideas.

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6. There are two kinds of hypotheses: correlational hypotheses and causal hypotheses. "Smoking and cancer are correlated" is a correlational hypothesis, while "smoking causes cancer" is a causal hypothesis. In order to establish a correlation, all that we need to do is observe a representative sample (which can be typically ensured through random sampling and large sample size). Correlations do not call for experimentation. But to establish causation, scientists will need to experiment.

7 Classical examples of omission of data that did not fit in with the scientists' ideas are Milliken's oil drop experiment and Gregor Mendel's experiments with peas – both did not pose any serious consequences later for the hypotheses. Some argue, however, that these were not ethical and that the hypothesis of quarks would have come earlier if Milliken had not suppressed some of his results.

8 Experiments were seen as a tool for corroboration of hypothesis/theory till Karl Popper and others pointed out the problems with this approach. Now most scientists accept that experiments are done to falsify a hypothesis or theory. See Karl Popper's *Conjectures and Refutations*.

For example, the theoretical work of Albert Einstein suggested that light should bend in response to gravity. Years later, Arthur Eddington, an experimenter, took advantage of a solar eclipse to test this. Indeed, light from a distant star was seen to bend due to sun's gravity, giving credibility to Einstein's work.

> **The most exciting phrase to hear in science, the one that heralds new discoveries, is not Eureka! (I found it!) but rather, "hmm.... that's funny...."**
>
> *Isaac Asimov*

Scientific communication

After the experiments are done, the results, along with the data, are sent to scientific journals for publication, or sometimes reported at scientific conferences. Quite often, the report may be rejected. But if it is worth publishing, the editors of the journal will send it for peer review.

Scientists in the same field review the report (also called a paper) and suggest changes or point out loopholes in the argument or the methods adopted in the experiment. The editors of the journal may also insist on stylistic changes to conform to the general style adopted in the journal.[9]

When ultimately, the report does get published in a peer-reviewed journal, it is a few months after the report was actually written. The scientific community looks down on scientists who approach the media to report their work before it is published in a peer-reviewed journal.[10] This is the reason why many scientists are reluctant to talk to media professionals.

The manner in which scientific data and discoveries are communicated is slowly changing because of the Internet. The insistence on publication in print was due to the need to establish ownership of the idea or discovery. The reluctance to share data is due to the stiff competition between different laboratories working on the same topic.

The Internet offers the means to establish who floated an idea first or who brought out the data first. Wikis and blogs are faster ways to communicate scientific results. Science develops faster with the cooperation and collaboration that the new tools offer. Thus, the Internet is changing the way scientists work and communicate their results.

> **It is the tension between creativity and skepticism that has produced the stunning an unexpected findings of science.**
>
> *Carl Sagan*

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9. Compare the instructions to authors given by journals like *Nature, Science and Current Science*.
10. Compare this with the approach of "breaking news" adopted by broadcasters.

3

Structure of science

The order and manner of scientific discovery is often obscured by the manner in which the results are put forth and, later, by the way it is taught in schools and colleges. Science puts high onus on logic and rigour. Certain structural features of the scientific edifice that scientists build up are explained here.

Definitions

Quite often when explanations are attempted, we may need to formulate new concepts. The words that are used for the new concepts may have some connotations that are incidental because of common use. These have to be removed so that what follows the definition in a scientific argument is precise and does not lead to any ambiguity.

For example, in physics, "work done" is defined as the force applied on a body multiplied by the distance it moves. So, you may sit at the editing suite and edit a programme in eight hours. But you would have done much less work than a person climbing a flight of stairs in a few minutes. This is acceptable within the context of classical mechanics.

A definition is neither true nor false. In a scientific work, if you see a definition, accept it without question. But if the word that is defined is used with any other meaning within the scientific work, you could criticize it. Thus, you may accept the definition of work done given in classical physics, though the ordinary use of the phrase may have a wider meaning. Thus, if you find any discrepancy when you replace "work done" by "force applied multiplied by distance moved", you could raise questions. The definition has to be consistent within a body of work.

Many arguments – even between friends or colleagues – may continue ad nauseam if nobody bothers to define the words used.

The tendency to define terms precisely and use them consistently is not shared by some softer sciences. Some textbooks on sociology or psychology may provide alternative definitions and proceed without using any of them consistently, later, in the discussions.

Theory, axioms, postulates

In coffee-table conversations, the words, "hypothesis" and "theory", are used quite loosely. They tend to mean the same thing. But theories are much larger constructs than hypotheses. While a hypothesis is formulated in one (or few) sentence(s), theories have quite a few deductively arrived at sentences – mathematical or plain day-to-day language.

> **The scientific theory I like best is that the rings of Saturn are composed entirely of lost airline luggage.**
>
> *Mark Russell*

When scientists formulate theories, they try to make their assumptions very clear. Generally, theories are put forth at the very beginning and are called postulates (or, rarely, axioms). The deductive logic that follows may also use well-established facts, hypotheses, laws or principles. Like hypotheses, theories are tested through experiments. And, quite often, predictive power is a testing stone against which theories are evaluated.

The discovery of new planets based on Newton's theories and the finding that light bends when travelling through gravitational fields, based on Einstein's theory, are typical examples of the discovery of new phenomena based on theories.

The principle of the axiomatic method of theory building is based on Euclid's geometry, in which a whole host of geometrical results could be derived from a few postulates. A totally new geometry can be constructed if the axioms are changed.

However, this is not normally done in science. The experimental corroboration of a theory increases the trustworthiness of the axioms/postulates that it uses.

Laws, principles

Laws and principles have more or less the same standing in science. They form the backbone of explanations. To explain the motion of planets, we use Newton's laws of motion. To explain the behaviour of inanimate objects on earth, we may have to use laws of friction as well.

Unlike traffic laws or criminal laws, when scientific laws are broken, nobody is punished. Instead, the laws have to be discarded.

4

From journals to textbooks

As a TV or radio producer, quite often, one may need to go to the original source of information.

> **Science... never solves a problem without creating ten more.**
>
> *George Bernard Shaw*

The first most authentic source of scientific information is the scientist himself. However, quite often, scientists refuse to talk to the media. To persuade a scientist to talk, you may need to convince him that you know the subject well enough and will not distort the results of the research.

To convince the scientist that you know the topic, you may need to do some background reading before you talk to him. You may start with encyclopaedias and lecture notes before you read up on some of the relevant scientific papers, though the historical flow of scientific information is the other way around.

This section will help you understand the manner in which science trickles down from the original research to textbooks and lecture notes.

Scientific journals

Scientists communicate their finding through scientific journals. Some of the multidisciplinary journals also provide popular introductions to scientific papers in an attempt to provide some background to scientists from other disciplines. News and views, opinions, book reviews and so on are also present in some journals.

The websites of science journals will provide some clues on current topics of interest. Take a look at some highly credible multidisciplinary journals' websites. Here are some examples to start with: http://www.sciencemag.org/, http://www.nature.com/, http://www.pnas.org/

You can read the papers in the journals only if your broadcasting organization is willing to subscribe to the journals. Otherwise, you may have to go to the nearest university library to read the printed version of the journals.

Structure of a scientific paper

Even though each scientific journal may have their own specific styles, there are certain elements that are common to all scientific communication.

> **We are drowning in information but starved for knowledge.**
>
> *John Naisbitt*

1. The title usually gives a clue as to the topic and sometimes gives the main point of the scientific paper.
2. Then there is an abstract, which gives the gist or summary of the whole paper. To make it easy to search by machines, there might be some key words.
3. In the main body of the paper, there will be an introduction or background, which provides references to the published papers where the problem is highlighted.
4. The methodology (experimental methods and materials) adopted to solve the problem is then given in detail. When methodologies developed earlier by other scientists are used, the appropriate references are given.[11]
5. Next, the data from the experiments (experimental results) are provided.
6. A discussion of the results (interpretation of the results) follows. Quite often, the discussion will clarify the limitations of the experimental methods, results or the interpretation.
7. The references to earlier papers, mostly by other scientists, are given at the end.
8. The name of the scientists authoring the paper and their institutional affiliations are also given in the paper, though the placing of this component may vary from journal to journal.
9. The paper may also credit the agency that funded the research.

Review articles

When a large number of scientific papers accumulate on a specific topic, one of the scientists may decide to bring together the results from all the relevant

11. In theoretical papers, you may not find experimental methods, materials or experimental results. However, the other components described here are common to purely theoretical papers also.

papers. This results in a scientific review. Some scientific journals may print reviews also. The main source of scientific reviews is yearly publications specifically aimed at that purpose. These yearly volumes may come under the title of "Annual Review of …" or "Annals of…". Some annual reviews can be accessed at http://www.annualreviews.org/. Libraries in universities with science departments or your national science library may have a better collection.

Such reviews may give references to all the papers that are taken into account. This may include the names of the scientists who have authored the original papers. Sometimes, if there are multiple authors, only one name is given and the rest of the names are hidden under the term et al. (and others). The institutional affiliations, addresses and so on, which appeared in the original papers, disappear altogether in the review and only the reviewer's details are given.

Since reviews bring together many scientific papers, they are really secondary sources. However, they will help you gather a general background of the status of research in the discipline and your topic of interest quickly. But since they are written for other scientists in the same discipline, they will include quite a few technical terms. Encyclopaedias are quite useful in getting a grip on technical terms,.

Encyclopaedias

Besides the general and popular encyclopaedias, there are some that specialize in science and technology. (For links to online encyclopaedias, see page 17). These pick up the basic and important points from reviews and papers. When this happens, sometimes the names of scientists are cut down further.

Textbooks

Scientific discoveries take a lot more time to enter textbooks. There are too many committees and lots of discussions about the relevance of the findings for the next generation. Ultimately, when new information is included in the textbooks, the references to scientists are mostly excluded. The experimental methods and the logic used by scientists to come to their conclusions are also often excluded. Alternative hypotheses and theories that competed earlier are not even mentioned. This gives rise to the general impression that science is divine inspiration available to a select few, rather than the outcome of the social activity of a large number of scientists. The notion that ideas in science are subject to change and evolution may come as a surprise to students and confuse them.

Exercise

1. Take a few issues of multidisciplinary, peer-reviewed journals such as *Science* or *Nature*. Or, if you interested in a specific field like medicine, take journals such as the *Journal of the American Medical Association*, the *British Medical Journal* or *The Lancet*.
2. Examine the structure of the whole journal. (Journals do not contain only papers, but also news, reviews, opinions and book reviews.)
3. Take a few more issues of the same journal and check whether the same structure is followed.
4. Once you identify the structure of the journal, it is easier for you to navigate it to reach the kind of content that you want.

5

Reading a scientific paper

Media professionals do not usually read scientific papers. But you do have an edge over other producers if you know how to approach a scientific paper. The best way is to build up background understanding before you start reading scientific papers. Take a bottom-up approach. Read the entries in encyclopaedias first and then a few review articles on the topic. Quite often, you may get enough information to talk to the scientists in the field or to even make a programme. But there are times when you may want to interview a particular scientist and, at such times, it is always better to take a look at the papers that the scientist has published. It will allow you to ask relevant and important questions that you might otherwise miss out.

> **In science the credit goes to the man who convinces the world, not the man to whom the idea first occurs.**
>
> *Sir Francis Darwin*

When you are reading a scientific paper, your approach need not be the same as that of a scientist. The title will quite often tell you whether the paper has any content that will be of interest to your target audiences. But sometimes, the title may be quite abstruse and couched in technical terms. So, take a look at the abstract as well.

If you feel that there is a possibility that your target audiences may be interested in the topic, take a look at the introduction. The introduction is usually easier to understand than the abstract because it has fewer technical terms. It will also put the context of the research in perspective. In addition, the references given here might give you some idea about the work done earlier by others in the same field.

Given the tight deadlines that media works under, it is better to skip the materials and methods and jump to the discussion at the end of the paper. Here, you may find arguments about why the results are important.

Peer-reviewed papers may also have some remarks about the limitations of the results in reaching firm conclusions about some aspects of the phenomenon. The importance of the findings as well as the limitations of the interpretations will give you clues on how to pitch your story. If you are preparing to interview a scientist, it might give you topics for some open-ended questions.

Unless the results are so important that you want to cover the manner in which the scientist designed and conducted the experiment, you need not read the materials and methods or the data that is presented in the paper. Leave that to other scientists. They will examine the methodologies adopted and the veracity of the results by conducting the same experiment themselves.

(If, however, it is a local scientist, you may like to dwell on the experiment since it gives your audiences insights into how scientists really work. This is especially true if you are working for TV. Experimental procedures offer a chance for a lot of action shots, which might make your programme very attractive visually.)

There are times when the paper has terms that you do not readily understand. You might need to check encyclopaedias to understand the meanings of technical terms. Methods for searching on the Internet are given in a later section, "Searching and researching for science stories". A quick peek into some online encyclopaedias could give you the relevant background to understand the paper that you are reading.

Online encyclopaedias

Wikipedia and Answers.com can give you quick and basic information about a vast majority of subjects. Quite often, the information may be scanty. Do remember that this information is not necessarily very reliable or accurate. So, it is important to cross-check it.

Britannica.com (*Encyclopaedia Britannica*) and Encylopedia.com are general encyclopaedias with entries written by chosen experts, not open to all to contribute or edit, like Wikipedia is. So, these are a little more authoritative than Wikipedia.

There are quite a few other encyclopaedias on the Internet and some of them are quite specialized. Take a look at these general and specialized encyclopaedias:

McGraw Hill's encyclopaedia of science technology, http://www.accessscience.com/, is available online and can prove to be a very useful resource.

MedlinePlus' medical encyclopaedia is quite useful if you are covering medical or health issues: http://www.nlm.nih.gov/medlineplus/encyclopedia.html.

A good encyclopaedia of science can be accessed at http://www.science.dke-encyc.com/.

Though the *Oxford Illustrated Encyclopaedia of Science* – http://www.oup.co.uk/oxed/children/oise/ – is designed for children, sometimes, the illustrations could prove helpful for even adults. Follow the links to other sites that are equally colourful.

Biology encyclopaedia: http://www.beelib.com/biology_encyclopedia.html.

Agriculture encyclopaedia: http://www.ca.uky.edu/Agripedia/.

Earth encyclopaedia: http://www.eoearth.org/

Exercise

1. Select one scientific paper on a topic in which you are interested.
2. Read the whole paper and highlight in yellow the content that you think might interest your audiences.
3. Read the highlighted portions again and highlight the words, phrases or sentences that your audiences may find difficult to understand.
4. Try and reformulate the idea in simple, comprehensible, lay language.

6

Science magazines

If you do not have enough of a science background, you might like to start by looking at science magazines. These are not as difficult to follow as science journals. They are written mostly by journalists and are pitched at lay readers.

> **It is a good morning exercise for a research scientist to discard a pet hypothesis every day before breakfast. It keeps him young.**
>
> *Konrad Lorenz*

Journalists normally try to make a topic interesting and sometimes sensationalize scientific discoveries. So, please do not use the contents of science magazines as the basis for your programmes. You will need to go back to the original sources before you start preparing for production. However, magazines are useful in that they provide ideas and inspiration for interesting stories. So, here is a list:

New Scientist or the online version of the printed magazine, http://www.newscientist.com/, is a typical example.

Scientific American – http://www.sciam.com/ – contains quite a few articles from current and past issues, online-only features, daily news, trivia and weekly polls pitched at educated readers from scientists who are working in specific fields.

If you want to learn what journalists are finding "newsworthy" in science, you may like to take a look at http://www.highbeam.com/Science+News/publications.aspx, a site where you can find science news articles.

http://ksjtracker.mit.edu tries to track science stories in media with a view to creating a peer-review system. It also provides a broad sampling of the past day's science news and, where possible, of news releases or other news tips related to the publication of science news in the general circulation news media, mainly of the US.

If you are looking for a wide range of stories, you should surf these WebPages as well:

http://blog.wired.com/wiredscience/, the science section of *Wired Magazine*, covers the latest science news and developments.

http://sciencenow.sciencemag.org/ features all the latest science news, including daily news from *ScienceNOW*, science policy news from *ScienceInsider* and weekly news from *Science* magazine.

> **It is the mark of an educated mind to be able to entertain a thought without accepting it.**
>
> *Aristotle*

http://www.nature.com/news/index.html, a weekly scientific journal, shares the latest news, reviews and expert opinions in life, physical and applied sciences and clinical medicine from award-winning journalists.

http://www.sciencedaily.com/, one of the most popular science news websites on the Internet, offers readers the full depth and breadth of breaking news about the latest scientific discoveries in all fields in physical, biological, earth and applied sciences.

http://www.sciencenews.org/, a biweekly news magazine, covers important and emerging research in all fields of science for scientists and general readers.

http://www.sciencefriday.com/, a weekly science talk show, focuses on science topics in the news and tries to bring an educated, balanced discussion to bear on the scientific issues at hand. Panels of expert guests join *Science Friday*'s host, Ira Flatow, a veteran science journalist, to discuss science – and to take questions from listeners during the call-in portion of the programme.

http://www.scitechdaily.com/ offers the best-informed science and technology coverage and analysis you can find on a daily basis, sourcing a huge range of great writers and excellent publications.

http://www.newswise.com/libraries/scinews/ is a trusted resource for knowledge-based science news, embargoed research results and expert contacts from the world's leading research institutions: universities, colleges, laboratories, professional organizations, governmental agencies and private research groups active in the fields of medicine, science, business and the humanities.

Newswise also offers medical news separately at http://www.newswise.com/libraries/mednews/

Another site that focuses on health and medicine is http://www.naturalnews.com/

http://www.physorg.com/ is a leading web-based science, research and technology news service that covers a wide range of topics. These include physics, earth science, medicine, nanotechnology, electronics, space, biology, chemistry, computer sciences, engineering, mathematics and other fields in science and technology.

Exercise

1. Visit all the websites listed in this section.
2. Prioritize the sites that you find most useful.
3. Make a list of the sites that you would like to visit periodically.
4. See if any in your list provide subscription. (Subscription does not necessarily mean that you have to part with money. You may merely have to provide your e-mail id and you will get periodic updates in your inbox.)

Hint: Make use of the tricks to do this with help from pages 58 - 59.

7

Myths about science

A layman may have many misconceptions about science. Broadcasters have a role to play in breaking these myths and misconceptions. In this section, we will look at the following four myths:

1. The stereotype of the scientist as a mad, evil person; a social misfit.
2. Science is all about logic and imagination does not play a part in scientific investigations.
3. Science tries to make simple things complex.
4. Science tries to increase the number of concepts, some of which are totally unnecessary.

> **It is through science that we prove, but through intuition that we discover.**
>
> *Jules H. Poincare*

Science as a social activity

Most scientific papers are co-authored by many scientists.[12] Unlike the popular notion of scientists and scientific activity, there are no white-coated, bespectacled, absentminded people working alone by themselves, shut away from any kind of social life. Scientists can be gregarious, fun-loving people,[13] and may lead a normal family life. The only thing that distinguishes them from other professionals is their interest in a topic and their willingness to stick to rigorous logic and experimentation.

12. For example, the average number of scientists per paper in food research is more than four, according to http://digital.csic.es/handle/10261/4394. Scientific papers with more than ten authors are not uncommon.
13. See, for example, Richard P Feynman's *Surely You're Joking*, *Mr Feynman: Adventures of a Curious Character*.

Intuition and creativity in science

If we look at the scientific papers being published today, it might appear that science is a dry, logical, analytical pursuit. Yet, intuition, inspiration and creative leaps of the imagination play a major role in scientific inquiry. There are quite a few legendary stories about scientists that highlight their points of inspiration:

1. Archimedes running out of the bathtub, inspired by the weight loss he felt along with the rise in water level when he immersed himself (which gave him the insight needed to solve the problem of finding out whether copper had been mixed into the gold in the king's crown).
2. Newton sitting under an apple tree and seeing an apple fall (which gave him the inspiration to understand why the moon revolved around the earth, instead of going off at a tangent in a straight line).
3. Kekule nodding off to sleep near the fireplace on a winter night and dreaming of a snake eating its own tail, which inspired him to consider a ring structure to explain the six atoms each of carbon and hydrogen in benzene.

> **Intuition will tell the thinking mind where to look next.**
>
> *Jonas Salk*

The rigours of writing a scientific paper hide these points of inspiration.[14] The weight loss of objects when immersed in water, apples falling and vivid eidetic imagery when falling asleep are inconsequential and immaterial in scientific explanation. But such points of inspiration – the "aha!" experience – of scientists are useful to broadcasters who have to tell stories to attract audiences.

Analysis and synthesis in science

> **Every great advance in science has issued from a new audacity of the imagination.**
>
> *John Dewey*

Scientific papers are the first step in dehumanizing scientific activity. When a large number of related scientific papers accumulate, one of the scientists involved in the topic may decide to do a review. Unlike film reviews, which are normally a critical appreciation of one film, scientific reviews are not a criticism of one paper. Annual reviews are a synthesis of the findings of a large number of papers.

Science is not about only analysis. "Lysis" means to break up. If we want to solve problems, it is indeed advisable to break up a problem into its smaller components.[15] And then solve the components, or the smaller problems. But ultimately, we have to solve the bigger problems by combining the solutions. This needs synthesis. The scientific reviews represent a part of such synthesis.

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14. For more such tales, see Arthur Koestler's *Sleepwalkers: A History of Man's Changing Vision of the Universe*, 1959.
15. Peter B Medawar's *Advice to a Young Scientist*, Alfred P Sloan Foundation Series, The Perseus Books Group, 1981.

> **When I am working on a problem I never think about beauty. I only think about how to solve the problem. But when I have finished, if the solution is not beautiful, I know it is wrong.**
>
> *Buckminster Fuller*

Quite often, what seemed separate and disparate phenomena earlier suddenly come together as one – as an explanation to an entirely third phenomenon. Magnetism and electricity, for instance, were brought together at the end of the nineteenth century to explain the phenomenon of light as electromagnetic radiation. Such synthesis forms the core of real scientific advance, perhaps more important than the tiny steps taken by analysis. Other examples of major scientific advances in the last century are synthesis of matter and energy, space and time. The synthesis of electrical, magnetic, gravitational and nuclear fields into a unified field theory is being attempted now.

Simplicity and complexity

Science is often seen as quite complex and difficult. It is interesting to note that the explanations for simpler phenomena are more complex than the explanations of more complex phenomena. Thus, physics, which deals with simpler phenomena, is more difficult to "understand" than, say, psychology or sociology, which deal with highly complex phenomena.

This is because we use day-to-day language when discussing "softer" sciences such as psychology and sociology. But when dealing with topics in physics, a logically rigorous and symbolic language called mathematics is used.

As psychosocial beings, we "understand" intuitively about others and about social situations. But this understanding is different from the understanding that comes out of scientific explanations. Scientific understanding has a predictive component. For example, if we see two people together in a specific situation, we cannot predict how their relationship will evolve. But if we have two atoms, say, hydrogen and oxygen, in a specific situation, we can predict the outcome.

It is interesting to note also that, as the softer sciences advance and become harder – more rigorous and deductive in their reasoning – mathematics is inescapable. Biology[16] and economics,[17] for example, have already started using mathematics.

Occam's Razor

Serious scientists do not want to deal with unnecessary concepts, definitions, axioms and postulates, which do not lead to any useful results. These are thrown out of the scientific edifice as and when they are discovered. This is more rigorous than the principle that media editors use: "When in doubt, throw it out."

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16. See the Journal Theoretical Biology. You can get to see a free sample issue from www.elsevier.com/

17. Econometrics

8

Politics, sociology and economics of science

Most of scientific research is funded – by the Government, by industries or by philanthropic organizations. The research done in universities is also quite often fully or partly funded, or at least subsidized. Thus, economics plays a role in scientific research.

Since there are ministries of science and technology in most countries, politics and politicians also play a role. Politicians need scientific advisors to help them formulate relevant policies. And scientists lobby with politicians to increase budget allocations for specific areas of scientific research. Thus, there is an interface between politics and science.[18]

Scientific activity is a social activity. The sociology of scientific activity has itself become a topic for research.[19] The social organization of scientific research, power struggles between scientists – they are human, too – and their ceremonies merit anthropological investigations.

> **No science is immune to the infection of politics and the corruption of power.**
>
> *Jacob Bronowski*

Media professionals have to be alert to the Politics, sociology and economics of science. The biases introduced by external factors into scientific investigations may otherwise creep into your reports. This section is a brief introduction to the topic.

Science policy

Most governments have a science policy to govern the manner in which

18. The controversies about priority of discovery between Isaac Newton (England) and Gottfried Wilhelm Leibniz (Germany) and, more recently, between Luc Montagnier (France) and Robert Gallo (the US) became political issues.
19. See, for example, the works of Bruno Latour, a French sociologist of science.

funding of scientific research is prioritized and managed. The science policy of your country is the key to understanding why and how scientific research is doing well (or not so well) in your country.

> **Politics is more difficult than physics.**
>
> *Albert Einstein*

Scientific understanding has implications for health, environment, economics and education. So, a science policy may also give some details on how science is used for formulating public policies.

The media, as a watchdog of society, has the function of looking into how scientific research is sometimes manipulated by fund flows. The media has the function of keeping governments on their toes by pointing out the unscientific bases of their public policies. On both counts, you need to take a good look at the science policy of your country.

Scientific research is quite often categorized into basic science and applied science. The government officials (who do not sometimes understand science) responsible for meting out the funds are often interested in only what gain the research would have for society. This would focus research only on immediate gains. The use value of science for society is important, but should not preclude research on basic issues. Basic science that today does not seem to have any utilitarian value may throw up unexpected gains tomorrow. And the funding that goes into more promising "applied science" may quite often not be able to fulfil its promises.

Once you have an idea of the science policy of your country, you can keep track of the scientific research that is being done under government funding. Be critical of both the policy and the research that is being done. Between the macro-perspective of the policy and the micro-perspective of the passions that drive scientific research, there are often no links. Media reports can help to fill this lacuna.

> **There are no such things as applied sciences, only applications of science.**
>
> *Louis Pasteur*

Research and development

Industrial and commercial funding of scientific research is not oriented to public interest. Profit is the prime motive, though quite often, the company investing in research and development presents itself as a good Samaritan.

Though the motive is profit, quite often, the outcome is better scientific understanding of phenomena. However, media professionals have difficulty in reporting scientific research undertaken by private industrial or commercial houses since these would not like to divulge the details of their projects to their competitors.

Quite often, the research that is published by such funding could also be biased, especially if the results are helpful in promoting a product. Interest groups often manipulate research on pharmaceutical products and food supplements. If you are not wary about this, you may end up doing inadvertent propaganda for their products.

Academic research

Researchers in universities and publicly funded laboratories are driven by the dictum, Publish or Perish. A larger number of publications are useful to get promotions. Hence, there is a possibility of the same paper with minor variations coming up in different journals. Since the number of citations is considered important, the social network that exists amongst scientists would help. Friends could find ways to cite each other's papers, even though they may not be too relevant or important.

Questions to ponder

Which are the scientific research institutions and universities in your country with the maximum number of publications in peer-reviewed journals?

Who are the scientists who have a very large number of publications to their credit?

Who are the scientists who get the maximum number of citations from other scientists?

Techniques to find answers to such questions are given in a later section in this book. (See page 63)

Exercise

Get a copy of the science policy of your country. Does it pay adequate attention to basic research or does it focus primarily on applied research? Compare it with those of other countries.

9

Applied and basic sciences

As explained in the earlier section, the difference between applied and basic sciences is very diffuse since what seems basic science today may well become the basis for many applications tomorrow.

Yet, fields like medicine, engineering, agriculture and even environment have important implications for the common man. Hence, your reporting in these areas will go through the media gatekeepers more easily.

And indeed, in these days of fragmentation of audiences, media channels that focus only on health or agriculture are quite feasible. It is precisely in these areas that you as a reporter must be careful about vested interests influencing scientific results, as explained in the earlier section.

Basic sciences

There are different classifications of sciences. A handful of categories are easier to remember, so let us broadly classify our areas of interest in the following manner:

1. Physical sciences (including chemistry, materials science, etc.)
2. Earth sciences (including astronomy and planetary sciences)
3. Life sciences (biology, including biochemistry, biophysics, etc.)
4. Cognitive and behavioural sciences (including psychology)
5. Social sciences (including sociology, economics, politics, study of religions and cultures, etc.)

Indeed, the contents of the earlier categories merge into the contents of the later categories. So, the ideas from physical sciences have implications on later categories, including life sciences and cognitive/behavioural sciences.

But this broad but loose categorization helps us while searching and researching for science stories.

Within these categories, many disciplines and sub-disciplines constantly grow and differentiate themselves, establishing themselves as valid areas of scientific enquiry. Quite often, this happens by merger of previously established scientific disciplines – for example, biophysical chemistry and neuro-immunology.

Applied sciences

Applied sciences have been categorized thus:

1. Agriculture
2. Medicine
3. Environment
4. Engineering
5. Technology

But again, these are loose categorizations. They also impact on one another. Developments in one field could have implications in the others. For example, agricultural practices impact health and environment. Technological innovations could lead to better diagnostic tools, improvement or degradation of the environment and improvements in agricultural practices.

Applied sciences get priority in the science policies of developing countries despite the fact that the driving force behind applied sciences is developments in basic sciences. However, it cannot be denied that applied sciences have a more immediate impact on society. And your audiences would find more relevance in reports about applied sciences than reports of developments in basic sciences. So, let us examine these topics in greater detail.

10

Health and medicine

Health is not merely the absence of disease. It is about physical, psychological, social and spiritual well-being. If Mr X has an illness, he may become bad-tempered (psychological) and his family stressed out caring for him, his productivity may decrease (social), he may be unable to enjoy the singing of birds and other delights that the universe presents (spiritual).

Good health cannot be brought about by medicines alone. Nutrition, exercise, social interactions and spare-time activities play equally important roles. Besides pathogens and parasites, genetic makeup, lifestyle, diet and the physical and social environments all have their impact on health. Sometimes medical conditions can be brought about by medicines also (iatrogenic diseases).

Quite often, the media picks up stories only for their sensational value – bird flu, swine flu and other major epidemic outbreaks. The silence on ongoing public health issues is deafening. For instance, diabetes, which is quite often not detected till it is too late, does not engage media attention despite the fact that it is an incurable (only controllable), lifelong illness, which causes a drain on the family, and, in some countries, on the national exchequer. Tuberculosis, which affects poor people more, is not a fashionable topic for broadcasters. Nor is cervical cancer, which can be prevented, but affects poor women in the developing and least developed countries.

Besides sensationalism, there is public interest, which will gain your channel the audiences it needs to survive and grow. And the public is definitely interested in their health. There is, therefore, a need to examine the public health system and to understand the major and minor illnesses that affect the citizens' health so as to be able to communicate effectively and efficiently to meet public interest.

The World Health Organisation (WHO) has classified diseases (international classification of diseases)[20] and most countries have accepted and adopted this classification. Most countries have started creating epidemiological databases on diseases based on this classification. An examination of such databases will give you a clear idea about which diseases you will need to focus on.[21] It will give you a long-term perspective on what your channel should do to address the health issues of your audiences.

A visit to the major hospitals in your city and a discussion with the health authorities will fill you up on the qualitative details that you may miss out on using just the statistical data. You can then prioritize the diseases that you would like to focus on.

> **Formerly, when religion was strong and science weak, men mistook magic for medicine; now, when science is strong and religion weak, men mistake medicine for magic.**
>
> *Thomas Szasz, M.D.*

Preventable diseases, communicable diseases, diseases that become complicated if undetected or untreated and so on must get more attention from broadcasters than those that are not preventable or have no cure.

It is also important to give your audiences choices in terms of medical treatment. If your country has alternative medical practices, give them adequate coverage. Plurality is good not only for the environment and human communities, but also in terms of medical practices. So, indigenous systems of medicine should not be excluded from your coverage of health. Naturopathy, homeopathy, Yoga, Ayurveda, acupressure, Siddha, Unani, acupuncture, aromatherapy, Reiki, spiritual healing – the systems allowed and/or practised in your country may be quite varied. Some of them do not have adequate scientific credibility, but have helped to cure and/or give comfort. Even a placebo effect is useful in reducing morbidity without leading to iatrogenic diseases (diseases caused by medication). It would be useful to spark off a debate on the comparative usefulness of different systems of medicine.

Encouraging citizens to take decisions about their own health and to provide the necessary information to do so are the tasks the broadcast media have to take up.

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20. ICD-10, the 10th revision of the classification of diseases, was endorsed by the 43rd World Health Assembly in May 1990 and adopted by WHO member countries in 1994. For details of the classification, see http://www.who.int/classifications/icd/en/.

21. For example, sleeping sickness or yellow fever may not be even heard of in your country if you are in Asia. Please note that the statistics for diseases are different from health statistics. A world report on health statistics is available at http://www.who.int/whosis/whostat/EN_WHS09_Full.pdf. It may be useful to compare the health statistics of your country with those of other countries.

Sources and contacts

When you are reporting on health, it is not only scientists and medical professionals that need to be tapped as sources. The ministry of health in your country makes a large number of decisions related to the health of the citizens. Health and politics have a very uneasy relationship since health policies can make or break a politician.

Besides politicians and bureaucrats of the health ministry, non-governmental organizations (NGOs) can be a good resource for programming related to health. NGOs that are focused on community development may treat health as just one of the issues they need to work on. But there are NGOs that focus specifically on health issues – on handicaps, autism or Parkinsonism, for example. Make a list of the NGOs in your region and make contacts. Don't wait for a reason. Making and cultivating contacts in this sector will prove to be helpful when you want to make a programme on a specific issue. The NGOs can provide the human resources and a face to the problem that you may want to depict. The turnover of activists in the NGO sector is not as quick as that in bureaucracy of the health ministry. So, a proactive step in this direction will prove to be fruitful in the long run. Providing some of your programmes in the form of CDs or DVDs for narrowcasting by the NGOs could win you friends who can come to help you in times of need.

The pharmaceutical industry and hospital chains are also useful contacts, though not necessarily for content. They could provide you sponsorships and advertisements – funds needed for producing good programmes. But be cautious in such relationships from the very beginning. These sectors have a vested interest in supporting your health programmes and they may want to influence the content. Make it clear that you will be editorially independent and that the support they may provide does not give them the right to call the shots. If you give an inch, you might end up miles away from where you wanted to go.

Keeping track of medical journals will give you an edge when you are talking to specialists. Here are some links that you might like to visit: http://jama.ama-assn.org/, http://www.bmj.com/, http://www.thelancet.com/.

Pitfalls of health communication

There are times when hopes are aroused by media reports about new medicines or services. If people cannot get what has apparently been promised to them by media reports, they become despondent and the credibility of the media goes down. So, be very careful when reporting on medicines or services that your listeners and viewers cannot immediately access. Quite often, you may have to work in tandem with the health delivery services for this.

Be very careful about reporting on new drugs also. Make sure that the new drug has gone through the first three stages of clinical trials. Most drugs have side effects and contraindications. Please make sure that your listeners and viewers understand this and do not resort to self-medication.

Be very careful about industry-sponsored research. The food industry and the pharmaceutical industry, in particular, are keen supporters of research and development. Unless you are alert to this, you could become a pawn in their game of profit-making.

"Did you know that 'an apple a day keeps the doctor away' was a slogan coined by an apple growers' association?" asks a media trainer.

Papers with very little experimental support may lead to fashions and fads. Low-fat diets, low-carb diets, etc., have avid followers because of media reports. Sometimes, these fads can prove to be health hazards. So, be very careful not to depend on media reports – at least never take them as the basis for your reports.

> **Whenever science makes a discovery, the devil grabs it while the angels are debating the best way to use it.**
>
> *Alan Valentine*

Links to resources

Directories

http://dir.yahoo.com/Health/Diseases_and_Conditions/

http://www.google.com/Top/Health/Conditions_and_Diseases/

http://dir.yahoo.com/Health/Diseases_and_Conditions/Genetic_Disorders/

http://www.diseasesconditions.com/

http://www.directorydisease.com/

Diseases, disorders and related topics: Karolinska Institute

http://www.mic.ki.se/Diseases/index.html

Centre for Disease Control and Prevention – alphabetic listing:

http://www.cdc.gov/DiseasesConditions/

Netdoctor: http://www.netdoctor.co.uk/diseases/

Vocational Information Centre: http://www.khake.com/page34.html

Click on the chromosome number and find out the related disease/disorder:

http://www.ncbi.nlm.nih.gov/books/bv.fcgi?call=bv.View..ShowSection&rid=gnd.preface.91

Symptoms and signs may quite often be mistakenly attributed to wrong diseases. Differential diagnosis is the term that doctors use to get to the right diagnosis. Here is a site that discusses some common wrong diagnoses:

http://www.wrongdiagnosis.com/diseasecenter.htm

Mayo Clinic:
http://www.mayoclinic.com/health/DiseasesIndex/DiseasesIndex

Health Insite – an Australian government initiative:
http://www.healthinsite.gov.au/topics/Conditions_and_Diseases

You will get a large number of health topics here:
http://www.healthinsite.gov.au/content/topic_map/topic_map.cfm

There are many people who blog about diseases: Technocrati Indexes Blogs. See http://technorati.com/tag/diseases

You can start from symptoms and signs. If you know the name of the disease, you can start from there. Alphabetical listing:
http://www.diseasesdatabase.com/
http://www.medicinenet.com/diseases_and_conditions/article.htm

http://www.journaliststoolbox.org/archive/medicalhealth-index/: The site provides links to miscellaneous medical/health sites, medical/health associations, links to medical/health news and journals and to medical/health studies and databases.

Exercise

Visit the above websites and evaluate them. Tips for evaluating WebPages are given in a later section (See page 60).

11

Agriculture

Most of the citizens of the least developed and developing countries depend on agriculture for survival. In some countries, the majority of people depend on agriculture for survival.

Science and technology related to agriculture have grown manifold in the last few years. Yet, these advances are not available to poor farmers. The broadcast media needs to serve these excluded citizens.

When broadcasters do serve the interests of farmers and peasants, it is often with a sense of superiority. City dwellers get all the slick and quality programming, while the rural folk are expected to be happy with poor quality monologues on farming practices. But then, the rural poor are also exposed to the same genres of programming as the city folks and their expectations have changed over the years. Media literacy has improved. Some countries have even started channels devoted only to agriculture, taking into account the fragmentation of audiences that has happened in the last three decades.

Like health and medicine, there are corporations interested in the money that the rural folk can spend on pesticides, artificial manure and agricultural machinery. So, the science of agriculture may also show distorted data and broadcasters must be cautious about this aspect. And like in the field of medicine and health, the corporations that are interested in your specific audiences are potential sponsors for your programming. A responsible and responsive policy on sponsorship and advertising is necessary if your audiences are not to fall prey to corporate greed.

Information about simple and effective agricultural practices spreads through word of mouth amongst farmers. In the age of the Internet, educated agriculturists have access to information and opinions from around the world. As broadcasters, you will need to interact with local farmers and keep your eyes peeled for the resources that are available on the Net.

Some resources

Online learning and teaching materials:

http://croptechnology.unl.edu/index.shtml: A collection of animated online learning resources explaining the science behind crop technology. Structured lessons are arranged in broad topic areas, such as crop genetics, molecular genetic analysis and weed science.

http://www.ecifm.rdg.ac.uk/: A web-based learning package from the University of Reading. Topics include environmental degradation, sustainability and land protection. Each module has a list of references with links to full text where available.

Databases

http://agricola.nal.usda.gov/

This is a free extensive bibliographical database on agriculture produced by the US National Agricultural Library. Records can be searched by title, author, subject and keyword. Abstracts are available for many of the articles. This database is updated daily.

http://dendrome.ucdavis.edu/

Dendrome is a collection of resources in forest genetics and biotechnology. Resources include information on genetic maps, PCR primers, DNA sequences and software.

http://www.fao.org/ag/agl/agll/prtplnu.stm

This accesses the Food and Agriculture Organisation (FAO) fertilizer online database and offers information on current fertilizer trends and documents on plant nutrition.

Electronic journals

AgBioForum (http://www.agbioforum.org/) is a quarterly full-text online journal on the economics and management of agricultural biotechnology, with short, non-technical articles on current research in agriculture, agricultural economics and biotechnology.

Forest and Shade Tree Pathology (http://www.forestpathology.org/index.html) is an online textbook for those studying forest and shade tree pathology, which offers information on fungi, decay, root and foliage diseases, rusts, cankers, wilts, viral and bacterial diseases, parasitic plants, abiotic diseases, declines, hazard trees and disease ecology and management.

Unasylva is an international journal of forestry produced by the FAO. It covers forestry and forest industries, including policy and planning, conservation and management, forest flora and fauna, siylviculture, agroforestry and rural development issues. http://www.fao.org/forestry/foris/webview/forestry2/index.jsp?siteId=2342&sitetreeId=8571&langId=1&geoId=0

Discussion lists and newsgroups

Ecol-agric (http://www.jiscmail.ac.uk/lists/ecol-agric.html) is a newslist for all those working in organic/biological agriculture, offering a discussion forum, research news, and information on conferences and new publications.

Resources for practical skills and knowledge

The European Commission's organic farming website (http://ec.europa.eu/agriculture/qual/organic/index_en.htm) provides a range of information on the EU agricultural sector, including EU legislation and guidelines, and general information on the development of organic farming in the EU.

DEFRA: Introduction to Farming http://www.defra.gov.uk/farm/farmindx.htm. This site gives information on farming policy, environmental issues, specialized information for farming sectors (for example, arable crops or milk production), and information on employment legislation in the industry.

Development Gateway: This World Bank initiative features information for developing countries on social, economic, technical and scientific development. Agricultural topics are covered extensively. http://home.developmentgateway.org/

CGIAR Library Gateway: The Consultative Group on International Agricultural Research (CGIAR) Virtual Library provides access to research on agriculture, hunger, poverty and the environment. The search engine taps into leading agricultural information databases, including the online libraries of all the CGIAR centres. http://vlibrary.cgiar.org/V?RN=974967558

The FAO manages databases and information systems containing over 50 alphabetically listed entries and provides comprehensive access to the organization's agricultural information. Information related to agricultural biotechnology, machinery, animal health, pesticide management, produce processing and so on are available here. http://www.fao.org/waicent/portal/glossary_en.asp

Network of Aquaculture Centres in Asia-Pacific (http://www.enaca.org/) offers the latest aquaculture news, forums, publications, and information on events and training. It addresses various topics such as genetics and biodiversity, health programmes, highland aquaculture, marine finfish aquaculture, shrimp farming and the environment. The site also offers links to databases and services such as marine finfish photos, FishBase, LarvalBase and Invasive Alien Species.

A good tutorial on resources is available at http://www.vts.intute.ac.uk/tutorial/agriculture/?sid=1339292&itemid=12029. It could be a starting point to help you organise the resources related to agriculture.

Factors to take care of

Information that is available on the Net is quite often not applicable to your country. Find out what crops and vegetables are cultivated in your country and focus only on those. Self-sufficiency in food is an important criterion for sustainable national development.

The timing of the broadcasting of your programmes plays an important role in their impact. Every crop has its own timing for planting, weeding, pruning, harvesting and so on. Scheduling your programmes based on the activities undertaken by the practitioners would give you more interested audiences.

Opportunities and precaution

Be careful about companies that are interested in agriculture. They would like you to promote their machinery, pesticides and fertilizers. Though you may get sponsorships from such companies, make sure that your editorial content is not influenced by the sponsorships and advertising that you get or the credibility of your channel will suffer in the long run.

Cultivating contacts

Agriculture is not only about farmers. The ministry of agriculture formulates policies relating to agriculture in your country. Get hold of all the documents and study them and keep yourself abreast of all new developments. The minister or the bureaucrats in the ministry may not have adequate experience in the realities of farming and may at times formulate policies that are counterproductive. Quite often, farmers are ignorant about the policies being formulated. You have to mediate in transferring the information from the ministries to the farmers.

Many countries have formal agricultural extension workers who are supposed to take the fruits of research to the farmers. Quite often, these workers are not motivated enough to do a good job. At times, they do not have adequate resources to do a good job. In both cases, you can be a catalyst by highlighting the good work some of them do and by providing some of your agriculture programmes (video and audio) as DVDs or CDs so that they can use these resources for their work in the field.

Fisheries and animal husbandry are mostly clubbed along with (and sometimes under) agriculture. If you are in a nation of islands or have extensive coastlines, fisheries would be a primary economic activity. Most fishermen have traditional knowledge about seas, lakes or rivers. When you communicate new findings, establish the new information in the context of the information that they already have. Use language they are familiar with, rather than the technical terminology that scientists are fond of using.

Exercise

1) Make a list of topics that farmers and fishermen would like to see or hear.
2) Search the above sites to evaluate their usefulness to you in your country's context.
3) Agriculture and fisheries have environmental impact or become a social issue. Make a list of such conflicts and disasters that have happened and draw lessons learnt.

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Environment

The issue of environment is considered "hotter" than agriculture by some broadcasters. Quite naturally so: The media feeds on disasters. Environmental disasters – manmade or natural – hog the headlines and lead news items. How can agricultural reporting compete?

Media personnel without an adequate background of environmental sciences cover most of the environmental issues. Combine this with the fact that the sources are quite often environmental activists who are also not adequately equipped with the right background knowledge of environmental science, but are moved by passions and good intentions. We have a recipe for disastrously wrong information going out to the public.

Without understanding earth and atmospheric sciences, you will not be able to question experts who talk about global warming and the ozone hole. If we were to interview a politician, we would not take his word for granted, but would counter his viewpoints and opinions with hard data. But if the same politician puts on the hat of a climate expert, suddenly, we find that we are hesitant to question him because we are not adequately equipped with understanding of the context and background.

Most broadcasters would not allow producers who have no understanding about political issues to cover politics. Yet, most media organizations are willing to assign a newbie to cover environmental issues. It is assumed that to cover environmental issues, you need no understanding, only production skills - which is not necessarily true.

Environment is a wide-ranging topic. From pollution of water, air and land to timber and forest produce extraction leading to degradation of forests, to construction of dams, to extinction of species – the issues involved are quite varied. Quite often, it is also related to other developmental or economic issues. It is important that we be adept at accessing relevant and credible information at short notice, so that we are armed with enough understanding to question self-styled experts.

Some resources

United Nations Environment Programme (UNEP) http://www.unep.org: This website provides a special page for journalists where you can subscribe to news feeds: http://www.unep.org/newscentre/.

You can search for a variety of topics and by region from the UN systemwide Earth Watch: http://earthwatch.unep.ch/. This is classified by Agenda 21[22] issues.

Water

The FAO has a water development and management unit. The focus, of course, is on water for agriculture, food security and poverty: http://www.fao.org/nr/water/.

Similarly, WHO has a focus on drinking water: http://www.who.int.topics/water/en.

UNESCO has a water portal, too, and you could subscribe to a bimonthly newsletter to keep you updated on issues and events at http://www.unesco.org/water/.

GeoNetwork (http://www.fao.org/geonetwork/srv/en/main.home) has a lot of interactivity and provides maps, GIS data and other relevant and useful information that could be used in your reports.

You could also subscribe to Water L – which provides a Listserve http://www.iisd.ca/email/water-L.htm to get a wider viewpoint and to keep abreast of the issues.

Wildlife

The World Wildlife Fund has a lot of information on wildlife, though only on a few select species. It also has quite a bit of scientific information and publications on a few select scientific disciplines at http://www.worldwildlife.org/. It has a specific focus on the earth at its site, http://www.panda.org/.

Climate

Climate is a topic that has gained popularity in recent decades. Here are some links to keep track of the new developments:

http://www.ipcc.ch/

http://www.tiempocyberclimate.org/portal/index.htm

22. Agenda 21 relates to the UN agenda for the 21st century to achieve sustainable development. The text of the document is available at http://www.un.org/esa/dsd/agenda21/res_agenda21_00.shtml.

Energy

International Energy Agency: http://www.iea.org/

International Institute of Environment and Development: http://www.iied.org/

General

The Institute for Global Environmental Strategies (IGES) is a research institute that conducts strategic policy research to support sustainable development in the Asia-Pacific region. It has developed a database of good practices, http://www.iges.or.jp/en/database/index.html, and it keeps an eye on current issues at http://enviroscope.iges.or.jp/index.php.

The Encyclopaedia of Life Support Systems (EOLSS) is a very useful site, which is thematically organized and updated quite often: http://www.eolss.net. But you will need to subscribe to access information from here.

Forestry

Convention on Biological Diversity: http://www.cbd.int/default.shtml

The UN's Special Forum on Forests: http://www.un.org/esa/forests/

The UN's Earthwatch: http://earthwatch.unep.net/forests/index.php

The World Heritage Centre's programmes on forests: http://whc.unesco.org/en/activities/

The Food and Agricultural Organisation's forestry site: http://www.fao.org/forestry/en/

The WWF forest section: http://www.panda.org/about_wwf/what_we_do/forests/index.cfm

The Forest Stewardship Council (FSC): http://www.fsc.org/en/

Contacts in government organizations and NGOs

International organizations can provide a large amount of general information on the issue of the environment. But if you have to make an impact on your audiences, you must take up issues of local relevance. Search for the websites of the government ministry or department related to environment and study the policies and action plans. Quite often, you may find contact details of the relevant people on the sites you search.

The government sector is only one of the actors in the drama of environmental issues. There may be quite a few NGOs and activists who are concerned about these issues and they may quite often have a different take from the government on them. The diversity of views presented provides variety and the spice of programming. So, make a list of NGOs and activists and make connections. Don't wait for the production to start before you contact them. It is better to make contact without an agenda and then go back with specific requests.

Make sure that you give voice to all strata of players in this drama – individuals, societies, NGOs, Government, Private sector, International agencies… - in your reporting. With so many different spring boards, keeping up should not pose a problem.

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Technology

Science is different from technology, but many people confuse the two. Science is about understanding phenomena. Technology is about using the understanding to make tools.

Understanding of natural phenomena is never harmful. But the tools that are produced could be put to use for constructive or destructive purposes.

So, for instance, the understanding that matter and energy are interconvertible – can be changed from one to the other – is important for our understanding of the world. But bombs that can convert matter into energy could be very destructive.

The lack of distinction between technology and science has made many people think that science is responsible for the harm that technology can cause.

Technology by itself is not harmful. It is people who want to harm that use technological products to harm others.

At times, lack of understanding of technology can also be unintentionally harmful. So, people need to understand technology. It prepares them to meet the challenges of life.

Life is becoming more and more technology based. TVs, computers and mobile phones are products of technology. Broadcasters, therefore, need to make technology – including the harm that it can be put to – understandable to the public.

New ideas pass through three periods:
It can't be done.
It probably can be done, but it's not worth doing.
I knew it was a good idea all along!

Arthur C. Clarke

> **Modern technology**
> **Owes ecology**
> **An apology.**
>
> *Alan M. Eddison*

The manner in which technology innovations take place and the way it diffuses is different from that of science. The steps that are taken to make profits out of technological innovations may be varied, yet there are some common features. So, we will discuss them separately.

Information technology is not the only technology there is, though, in the last few decades, information technology has become quite prominent and has impacted our lives in many ways. Biotechnology will not have similar visibility, though it may impact our lives in many silent ways. Agrotechnology, transport technologies, infrastructure technologies, military technology and so on will also change our lives.

To keep track of emerging technologies, it is important to keep an eye on patent systems. After the trade and intellectual property rights agreements between nations, many developing countries woke up to the economic nature of innovations. Most countries have seen an increase in the number of patents filed. Keep an eye on the global patent statistics – this may give you the necessary ammunition to report on the increase or decrease in innovativeness in your country.

Media attention on innovators is an important step in encouraging innovativeness amongst young people. Scientists and innovators can be made into celebrities just as much as film stars and football players, provided the media gives them proper coverage.

Innovators who patent their inventions are more tight-lipped about their work than scientists. They will not give away the secrets that could help them to profit from their patents. However, they are interested in commercializing their inventions and need to interest industrialists in their innovations. So, they would be willing to talk about the usefulness of their innovations, while concealing how they were achieved.

Cultivating contacts in the patents office, keeping track of patent gazettes and searching in patent databases are some of the important ways in which you can come to know about technological innovations.

The patents filed by individual innovators are easier to tackle since they will be more ready to talk. However, most of the patents are filed by companies, where the sense of secrecy is compounded by the bureaucracy. In such cases, contact the public relations and marketing departments , where they understand the mileage gained from media exposure, rather than the research and development department.

Even more important than covering innovations and innovators, is the need to look into the patent laws in your country. Despite amendments to suit the international pressures and industrial lobbying, there may be loopholes and lacunae that need to be filled in patent laws. Conferences and seminars on intellectual property rights or patents can give you the leverage to bring out issues, if you have background knowledge of the issues.

If you know the international patents classification (IPC) and the system of catchwords used for searching patents, you will be at an advantage when you are searching for patents.[23]

> **Our scientific power has outrun our spiritual power. We have guided missiles and misguided men.**
>
> *Martin Luther King Jr.*

The World Intellectual Property Organisation (WIPO) has a searchable database of patents: http://www.wipo.int/patentscope/en/

Google also has a patents search site where millions of patents can be searched: http://www.google.com/patents There are many other sites where you can search for patents, among them http://www.freepatentsonline.com/search.html.

Some of these, which have a large number of patents, as, for example, http://www.delphion.com/, would need subscriptions.

Like scientific papers, patents are not easy to read. Unlike scientific papers, patents are made obscure because of the legal language that is used. However, as you read more and more patents, you will get acclimatized to the language and be able to see through all the jargon.

When you read patents, you will realize that like scientific papers, they have a pattern. The first page will give you the details about where the product was patented, the patent number, the inventor, the inventions referred to, the patent attorney, etc. It will also give you a brief abstract of the innovation.

From the second page, you may see a description of the background, giving the context of the innovation and then the list of claims. Quite often, there are diagrams, which will be explained in detail.

Exercise

1. Get a copy of a patent. Study the structure of the document. Compare it with a scientific paper.
2. Make a list of patents filed in or from your country. Make a contact list of the innovators who have filed patents. Make an assessment of those innovators who could be profiled on your channel.

23. You can learn these if you visit http://www.wipo.int/classifications/ipc/ipc8/?lang=en.

Exercise:

1) Select one area where you would like to contribute: Science, Health, Agriculture, Environmentand and Technology.
2) Make a folder on Favorites / Bookmark. For tips see pages 58 - 59.
3) Create subfolders in the following manner:

    Educational materials

    Publications

    Electronic journals

    Bibliographic databases

    Library catalogues

    Internet research tools

    Professional organisations

    Conferences and events

    Social media

    News and media

4) Organise the websites that you see in your areas of interest so that there are at least three links in each sub-folder.

Part 2

Science in Broadcasting

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Science in broadcast media

Presentation of scientific topics through different media poses varying degrees of challenges. The print media allows referring back to the information that a reader has already gone through. Radio and television programmes exist in a temporal plane – their audiences cannot go back to what has been said or shown. The producers cannot afford to assume that the audiences will remember facts that have been presented earlier. Every point that is made has to be self-explanatory and cannot refer to facts presented earlier in the programme.

The readers of a newspaper or a magazine will always start reading from the headlines. But quite often, the listeners/viewers may switch on the radio/ TV set in the middle of a programme. This challenges the ability of radio and television producers to attract and retain the interest of the listeners/ viewers.

Science, by its very nature, is quantitative and insists on being exact. Radio and television producers tend to shy away from putting in too many numbers in their narration script and, if at all they do so, they round off figures since exact figures are not easy to remember.

In spite of these challenges, the broadcast media does manage to mediate science to its audiences in an exciting manner. In this part, we explore some of the essential tricks and tips to do this.

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Why is science easy to report?

There are quite a few aspects of science that make it a producer's pet subject. Any story starts with "who, when and where". "Once upon a time, there was a king in Serendip…" is a typical beginning for a story. Producers can use what science drops in its inexorable march towards truth and humanize science once again. The story can be about the scientist who is working in a specific laboratory.

The second part of the typical story is the challenge that the hero faces. "The king of Serendip does not have any children in spite of having many wives." The challenge in a story about scientific advance is not in the realm of fantasy like in folk or fairy tales. It is about the real world. But it can be made as gripping if we present the challenge in the right way.

Putting forth the possible solutions that the scientist considers can move the narrative structure of the story forward. As in a fairy tale, one by one these solutions face obstacles. They turn out to be erroneous, are criticized by other scientists or there are results that contradict them.

At last, the scientist thinks up a hypothesis that explain it and devises an experiment… Now we are reaching the climax. The experimental results corroborate the hypothesis!

The resolution follows – the third act in the three-act play. The scientist is congratulated and his work is accepted.

Of course, it is not necessary to have a scientist as the main character in every story. Science impacts our lives. If we ask ourselves what type of person benefits most with the discovery or invention that we are trying to explain, it will give us a clue to how to construct the story. For example, if the story is about a new drug to cure a particular disease, you could take off from the case study of a person who is suffering from the disease.

In any case, one of the main tasks of the broadcaster is to re-inject the human element into science, which assiduously tries to remove biases and, therefore, human elements.[24]

24. For biographies of scientists, see http://www.accessscience.com/biographies.aspx.

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Why is science difficult to report?

Developments in science and technology have a direct bearing on the everyday lives of people. Yet most people do not really understand science or technology. The reason is obvious. Science doesn't always lend itself to easy understanding due to its insistence on consistency and rigour. Some aspects even directly contradict everyday experience (a four-dimensional space-time continuum, for example).

Scientific articles tend to be heavily laden with technical terms and are sprinkled with mathematical equations quite often. So, the popular perception is that science is bland and dry. In the process, it contributes to scientific illiteracy. No wonder then that in the popular culture, people prefer to learn about pseudoscientific systems such as astrology or pop psychology than real science.

Scientific knowledge is no longer transmitted through communication from scientists to 'lay' people directly.[25] Scientific ideas and information have to be mediated to inform everyday social discourse, where it crops up in news and in debates about issues such as public health or food safety.

Broadcast media are powerful mediators of the transfer of information and ideas of science. In the current broadcast scenario, effective audiovisual communication of scientific contents is one of the most difficult jobs for producers, as they must face the intrinsic difficulties of science as well as those of the medium. This might be one of the reasons why, in many countries, science popularization and reporting do not enter programming schedules, in spite of the increasingly important role that science is playing in contemporary society.

25. There are however, very interesting and extremely comprehensible popular writings, videos and blogs by scientists. But not enough to keep the common people abreast of what is happening in frontiers of science that have impact on their lives.

Problems of science communication

Some scientists think that mass media are not the right platform to spread the knowledge they produce. There are some fundamental differences between the systematic nature of their work and the activity of the media. Let us look into these and see how we can overcome them.

Science attempts to put forth ideas in a systematic way and with a logical structure. Scientific issues, when taken to lay audiences, attempt to relate scientific discoveries to everyday life and tend to use narrative structures that create an effective connection with ideas that are familiar to most people. Narrative structures used in media are mainly of a poetic and dramatic kind. Instead of communicating intellectual, theoretical or technical knowledge in a detailed and logically structured way, the media tries to build interesting stories to be able to attract people's attention through practical interest and emotional appeal.

Reporters/producers quite often resort to simplification of the concepts of science. Some scientists think simplification inevitably means distortion of their truth. Some others do consider it possible to offer a true explanation of scientific issues in relatively simple terms, and that some topics are easier than others to simplify. Though in principle, there is no objection to simplification, there is always the danger of oversimplifying an issue to the point where a false explanation is offered just because it is easy to understand.

Scientific knowledge is not necessarily practical or useful and, to many scientists, it is more important to raise new questions than to offer practical solutions. The media, very often, does not even try to explain the true meaning of scientific discoveries, but only the practical consequences of the discoveries on everyday life. So, scientists feel disappointed when they see their discoveries reported in the media.

Mass media tend to approach issues that will raise immediate public attention, laying stress on aspects that are likely to make headlines. But, very often, such criteria do not coincide with those that make an issue remarkable from the scientific point of view. This trend has been regarded as unacceptable by scientists, since it places science on the verge of sensationalism. Some scientists think that since science is a serious matter, popularization and reporting should not be superficial or jocular. But some popularizers argue that there is a certain kind of "sensationalism" that has a positive impact in spreading scientific knowledge.

Producers work under deadlines. Quite often, there is not enough time to do adequate research to be familiar with the topic. So, there are times when the facts presented are not really right. Producers don't have to undergo peer reviews as do scientists and, sometimes, wrong information goes public without the broadcasters noticing it.

Because of the above factors, there is a tendency in the scientific community to look down upon colleagues who use the media to get publicity for their work. So, many scientists are not even willing to talk to the media for fear of arousing their colleagues' disdain.

The problem of information explosion

In spite of such difficulties and the intrinsic differences between science and the media, some examples of television and radio programmes can be found, which have succeeded in establishing an effective link between scientific issues and the viewers' and listeners' interest by means of communicating science in an interesting and understandable manner. But these examples are far too few.

We have examined how scientists work and report their findings in journals in the last chapter, and in this chapter, we have explored the reasons for public perceptions of science and scientists' perceptions of media. To make an effective bridge between scientists and the public, producers need to understand both points of view and try to face the inherent challenges. It is clear that producers have to understand and appreciate science if they are to report new developments.

In the twenty-first century, developments in science and technology happen on a daily basis. Thousands of scientific journals spew out millions of pages of results every week.[26] Even scientists find it difficult to keep up with all the new developments in their own disciplines. In such a situation, journalists/reporters/producers miss out on many important scientific discoveries and technological innovations, which have the potential to propel social development.

How can producers face the problem of this information explosion?

26. A list of searchable databases for scientific journals may be found at http://scientific.thomsonreuters.com/mjl/.

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Searching and researching

Most people who use computers and have logged on to the Internet a few times learn to "google" to search for information. But google.com is not the only way to search if you are into media. There are more than 20 search engines and the results that you may get from each may be widely different. There are also metasearch engines, which search using many other search engines and provide you a consolidated list of WebPages.[27] Experimenting with different search engines and metasearch engines will give you better results than depending on Google alone.[28]

There are three types of Internet search: search engines, subject directory and deep search. Search engines touch only the superficial surface of the Internet. In fact, if you use only search engines, you may miss a whole lot more information. Most people don't use subject directories or deep searches and miss important and in-depth information available on the web.

Search engines

Most producers today have learnt about searching on Google (http://www.google.com). Googling is a term that people use for conducting an initial search on the Net. Google is not the end of the story. There are many other search engines and they give you different results. It is a good idea to use different search engines for the same search and look at the first pages of each rather than use one search engine and look at several pages of the search results.

But most non-professional researchers have not learnt to go beyond inputting

27. For a list of search engines and metasearch engines, see http://www.internettutorials.net/engines.asp
28. You might want to search in your own language. You might find a link to a search engine that does just that. Try http://www.searchenginecolossus.com/.

keywords and clicking search. At times, this brings forth links to millions of web pages, and at others, you may get no results at all.

Most search engines allow exact phrase searches, Boolean combinations of search terms and so on. There are simple techniques to enable you to make full use of the facilities in search engines and to get what you want without looking at millions of web pages.

For example, if you key in the words, Evaluating Web Pages, as a search term on Google, you may get about 28 million "hits" or pages. But put quote marks around the search term thus, "Evaluating Web Pages", and the results may come down to about 16,000.

Now you could go into Google's advanced search and specify that you want only English language pages and that you want only PDF pages. That could bring down the results to about a 1,000.

Quite often, the term that you have used may have multiple meanings. For example, the word, "script", may mean a document that is written prior to producing a TV or radio programme, it may refer to a small computer programme that is embedded in a multimedia package, or it may refer to a financial instrument. So, if your search terms have the word script in it, it may throw up results from finance and computer science – more than 200 million pages! You could eliminate most of the unwanted pages from your search results by specifying the words that you don't want in the advanced search. So, put a minus (-) sign without space, before the words, "computer" and "finance".

Refining your search terms and using the full potential of the search engines can reduce the number of pages that you have to go through to find the information that you want.[29]

Directories

When you use a search engine like Google or Yahoo!, you may come across a few databases and directories. But not all of the entire deep web is covered by the spider – a software that crawls the web and creates an index of the all the websites so that quick results are available to you when you type in a search term.

Most search engines classify WebPages and present information as directories. Take a look at some of these directories: http://directory.google.com/, http://dir.yahoo.com/, http://www.dmoz.org/, http://www.sciseek.com/ www.lii.org, infomine.ucr.edu.

29. For advice and general Internet search tips, see http://www.journalismnet.com/tips/.

There are a large number of directories on the web. Quite often, they do not turn up when you put in your search term. When you key in the search term, add the word directory at the end and you may get to see them. For example, if you key in ionosphere in Google, you may get more than one million hits. But add the word directory after ionosphere and you may get a few thousand.

The best way to have a good idea is to have lots of ideas.

Linus Pauling

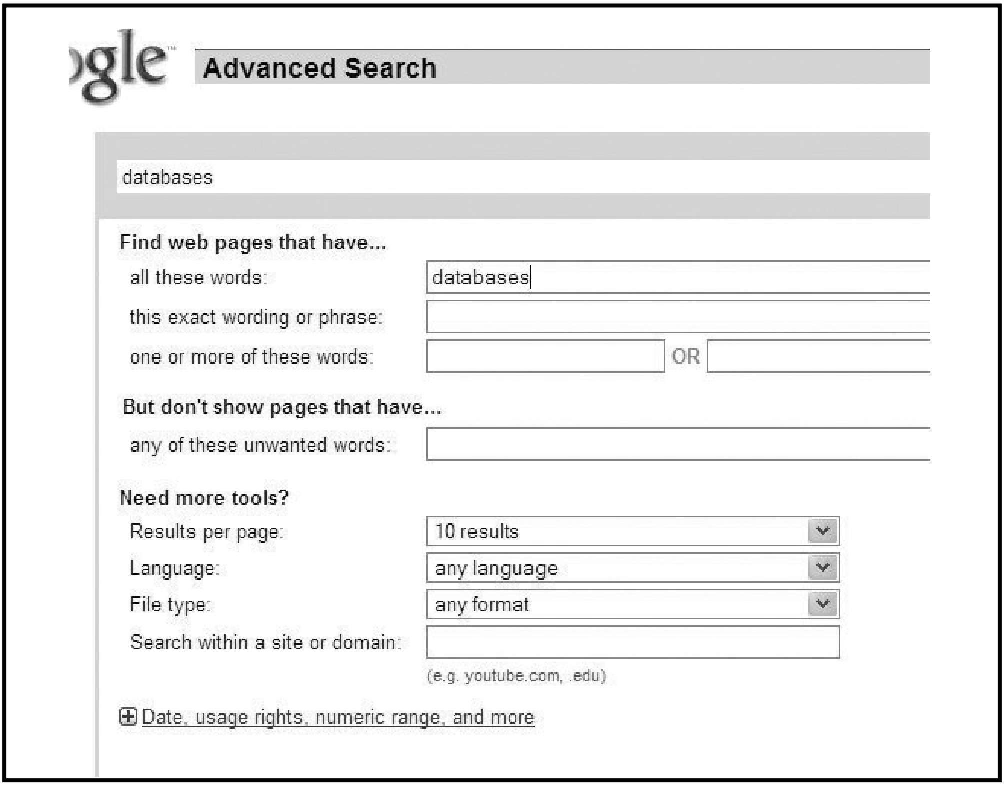
The directories give you information that you want along with information related to the topic that you are looking for. Information in directories are organized under broad areas of interest and, as you click on one, you will find sub-categories, helping you to narrow down your search.

As broadcasters looking for ideas, you may get excited and go off at tangents when presented with information. Quite often, you may forget what you are looking for and go after information that may be even more interesting. It is easy to get inundated with information, if you are not careful.

Saving time

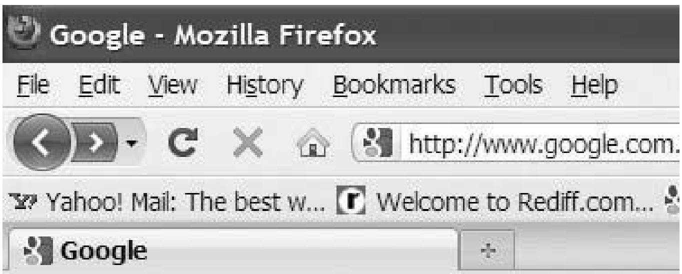
Whether you are searching using a search engine or going through a directory, you will ultimately come across a page that contains links to 10 or more WebPages as per your preference settings. Most search engines will give you the option of seeing more links per page. For example, if you are using Google go to Advanced Search (on the right side of the place where you type in your search terms) and select 100 sites per page instead of the normal 10. If you get 100 results per page, you could avoid having to click to go to pages 2-9 and thus reduce the time wasted in waiting for each page to open up.

Opening each page will take time, especially if you do not have access to a broadband connection and are using a dial-up connection. So, the best strategy is to right-click on the link and open the page you want to see in a new tab or window. You can open up a series of tabs or windows while the previous tab or window is being loaded. That will save you a lot of time.

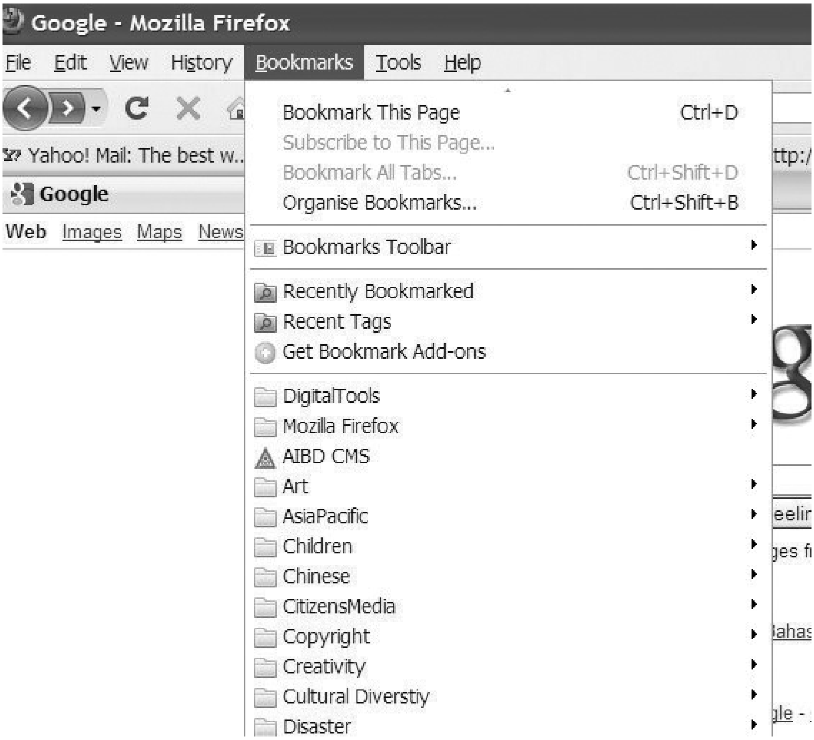


Organizing information that you come across on the Net

Then you go to each tab or window and evaluate the information contained in them. A quick glance will tell you whether it is worth reading or not. Whenever you come across interesting information in any webpage, remember to save the link to the URL by Bookmarking it (if you are using Mozilla) or putting them in Favourites (if you are using Internet Explorer). This way you can go back to the page whenever you want to, without having to note down the URL on paper. Otherwise, you may lose the link and later wonder where you saw a particular piece of information.



It is necessary to organize the links to the WebPages that you visit. If, for instance, you are looking for information on diabetes, put the links in Bookmarks/Favourites in a folder named Diabetes. Thus, you may have 20 or more links to information on diabetes in a folder within Bookmark/ Favourites.



Separating searching from researching

It is important that you do not start reading while you are searching. You merely scan for information to decide whether it is important or not and then save the links to important pages in Bookmark/Favourites. If you start reading instead, you might lose the chance to come across an even more important page.

Later, when you sit down to read, you could open the pages one by one or all together and read them. If you open them all together by using the Open All Tabs function in your Bookmark, you could evaluate which ones are the best and read only one or two to get all the information that you want.

Using this technique (collating under Bookmark/Favourites) and evaluating the relevance and importance of the pages before you start reading will reduce the time that you spend in collecting information. Since we broadcasters work under tight deadlines, any trick to save time during research is useful.

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Evaluating WebPages

The WebPages that you scan may not be very reliable. Sometimes, they may be sheer propaganda. It is sometimes useful to see who are the people behind the WebPages. Is the page you are scanning authoritative, accurate, current, objective?

Some WebPages are easy to evaluate. You might be able to detect the bias or incorrect information yourself. When that is not very evident, look for:

- References to sources of information
- Links to outside sources for further information
- Date of updating the page (usually given at the bottom of the page),
- Details of the author of the page with clear indication of his qualifications for writing on the topic (the author could be an organization – look for About Us, Background, etc., of the organization, if that is the case)
- Credibility of the organization behind the page (given in Contact Us or About Us) – that will give you an idea about any conflict of interest
- Sponsors of the page and advertising on the page (will give you an idea about the possibility of self-interest)

The URL of the site also gives some indication of the kind of organization behind the page. If it is a .com site, it is a company. If it is .gov, it is a government. If it is .org, it is an NGO or a social organization. If it is .edu, it is an educational institution. But there are times when you need to really double check. Otherwise, you may not be able to distinguish between propaganda and facts.

Who is running this webpage?

This is easy to check if the website has an "About Us or "Contact Us" tag, but even then, you cannot be sure whether the information provided is true.

There are also tools such as:
http://www.geektools.com/whois.php for checking .com, org and .edu sites
http://www.betterwhois.com/ for .com, .net, .info and .biz sites
http://www.allwhois.com/ for .com, .net and .edu sites

How popular is this site?

If there are a large number of people who visit a site, the chances that errors are detected and pointed out become larger. www.alexa.com will give you an idea of how popular a site is by giving you a traffic rank for the site.

Popularity does not necessarily mean accuracy or credibility. Ultimately, you will need to use the journalistic tools – the five Ws and H.

> ***Exercise***
>
> Check out the tutorial on how to evaluate a webpage at http://muse.widener.edu/~tltr/How_to_Evaluate_9.htm.

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Searching the deep web

Search engines and directories are only the first steps for a good media professional searching for information on the Internet. The fact is that if you rely only on search engines, you are not going beyond what your audiences can do on their own. Most children today know how to search for information using Google.

What you get as information on web pages may not be very reliable or accurate. It is better to see what scientists themselves are saying. As we noted earlier, scientists report their findings in journals. The details of publications in journals are available in databases, which are not accessed by search engines.

Search engines do not really search the World Wide Web directly. They search a database of web pages that it has harvested periodically. Search engine databases are selected and built by computer robot programs called spiders. These "crawl" the web, finding pages for inclusion in their database by following the links in the pages they already have in their database. If a web page is never linked from any other page, search engine spiders cannot find it. The only way a brand new page can get into a search engine is for other pages to link to it, or for a human to submit its URL for inclusion.

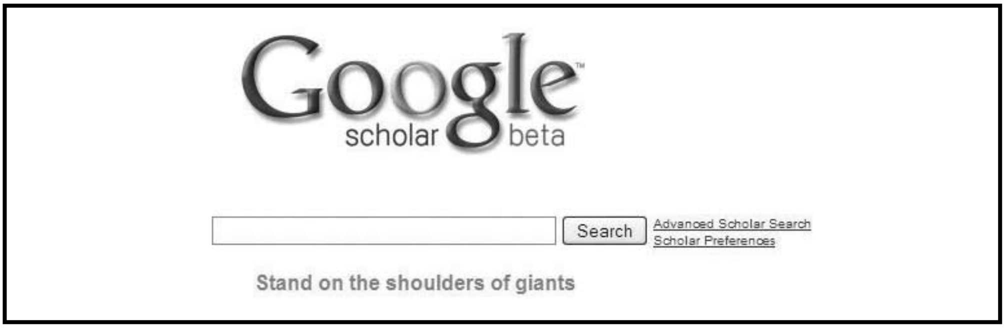
After spiders find pages, they pass them on to another computer program for "indexing". This program identifies the text, links and other content in the page and stores it in the search engine database's files so that the database can be searched by keywords. The page will be found if your search matches its content.

Many web pages are excluded from most search engines by policy. The contents of most of the searchable databases mounted on the web, such as library catalogues and article databases, are excluded because search engine spiders cannot access them. All this material is referred to as the "invisible web" or "deep web".

Databases

There are different types of databases: bibliographic databases from where you can get references to reading materials, abstracts databases from where you can get abstracts of scientific papers and full text databases from where you can get the full text of the paper you want to read.

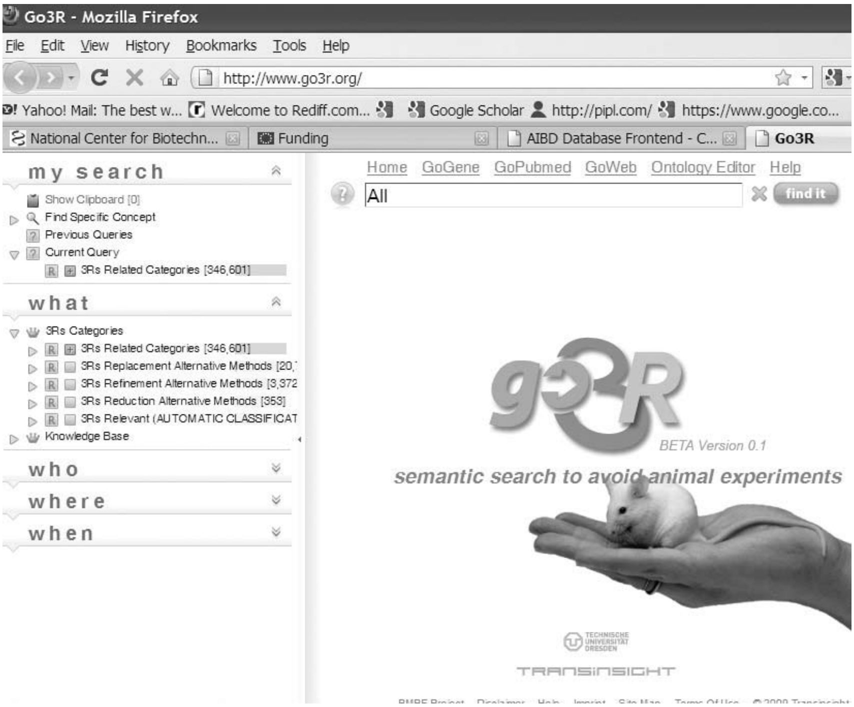
Google Scholar (http://scholar.google.com/) leads you to more academic materials – books, abstracts and papers from academic journals – and provides more in-depth information than Google.



http://www.scirus.com is another website where you can search authors, journals and scientific topics. Advanced search options for Boolean combinations of terms and preferences settings that allow only journals in specific subject areas or to include webpages, patents and so on are also provided on this website. Again, you may get only a few lines of the abstract. The search could lead you to Science Direct or other publishers and, if you are lucky, you may even get the full text of the paper that you need. The site also provides the latest science news from New Scientist, with relevant links.

Abstracts of papers from nearly 7,000 journals can be found on http://www.sciencedirect.com/. Some of these journals allow access to the full text of the papers. But to access most, payments may have to be made. Let this not deter you. Reading only the abstracts of the most recent papers will also give you an idea about the status of the scientific research in a particular field and prepare you to interview scientists.

http://www.go3r.org/ is organized in a different manner. It provides the beginnings of semantic search. It is more oriented to medical literature and its ideal seems to be related to reducing animal experimentation. The possibilities of search include criteria like who, when and where besides what. As you search, you will find that the structure of information available changes to help you narrow down (or expand) what you want/need.



http://www.scienceresearch.com/search/ searches databases and organizes the output in the same manner as go3r. The data available is wider than offered by go3r.

The Online Journal Search Engine (http://www.ojose.com/) is a website that helps you to search many databases and scientific publishers. You can search databases such as Scopus, Inist and Medline from here.

Quite often, you may find that you end up seeing only the abstract and need to pay up before you get to the research article. For producers from the developing world, this can be very frustrating. Fortunately, there are many journals that are more open. For a list of journals that you can access easily, see the directory of open-access journals at http://www.doaj.org/doaj?func=byTitle&alpha=J More journals are expected to open up access to their contents. Some have already made their archives (all but the more recent issues) available for search.

And if you have money to spare

The Institute of Scientific Information (ISI) started a trend in keeping track of scientific advances in the 1950s by keeping an eye on all scientific journals, recording their contents (Current Contents) and the references that each paper cited (Citation Index). Through the Citation Index, it became possible to move backward and forward in the history of contemporary science and to evaluate (roughly) the worth of each scientist's contribution to science. This enterprise was later taken over by Thompson Reuters. Take a look at http://scientific.thomson.com/, http://www.isiwebofknowledge.com/ and http://sciencewatch.com/.

While the Web of Knowledge covers arts and humanities, the Web of Science covers only science (http://www.thomsonreuters.com/products_services/scientific/Web_of_Science).

While these are great tools for accessing huge amounts of relevant information quickly and efficiently, the services offered have a cost. So, unless your organization subscribes to the services, they may not be of much use.

Some people like ProQuest as a starting point for database searches (http://www.proquest.com/en-US/).

> ***Exercise***
>
> Go back to the exercise given in the chapter on Medicine and Health. Try and do it again.

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Covering conferences

Many scientific conferences and seminars are organized every year in most countries – some national and others international. The national seminars and conferences may at times also have a few internationally acclaimed scientists as guests of honour.

Seminars, conferences and symposia are platforms that provide opportunities for scientists to meet their peers and to network. Quite often, such meetings result in the cooperation and collaboration of scientists from different laboratories/institutes. For the broadcasters, these meetings provide an opportunity for reporting science as "local" news.

If you want to cover conferences and seminars, you will need to know when and where they are being held. If you come to know of the occurrence of such events only by chance, then invariably, it will be too late to prepare for them adequately. It is better to seek out actively the scientific conference organizers in your country and get yourself registered on their mailing list.

A Short Checklist

1. Get a list of scientific institutes, associations and academies of science and their contact details.
2. Let them know that you are interested in covering scientific conferences and seminars.
3. As soon as you get to know about a conference, contact the organizers and ask them for a list of speakers and abstracts.
4. From the abstracts, identify the topics that you would like to cover.
5. Do a quick search of the names of the speakers for their earlier papers. This will give you the background details so that you can ask relevant

and important questions to the scientists that you have identified.[30]

6. Write down the questions that you would like to ask each scientist.
7. Contact the scientists and let them know that you are interested in interviewing them. Ask them for a draft of the paper that they will be presenting.
8. A few days before the conference, contact the organizers again and ask them for the papers of the scientists in whom you are interested. As a media professional, you have an advantage. You may need to leverage this to get the papers before they are presented.
9. You will have to find a quiet place away from the noise of the conference to interview scientists. If time does not allow a recce to identify the right place, take help from the organizers.
10. Review your questions on the basis of the papers that you have collected.

During the conference, the papers that are presented are only a part of the story. The coffee breaks and lunch breaks are sometimes more interesting because they offer opportunities to interact with the scientists and hold discussions with them. You could also join a group that is discussing an issue and get to hear interesting conversations that may give you more story ideas.

Exercise

Check for the conferences that you might like to cover in websites like http://www.conferencealerts.com/.

30. To find people, you could use specialized search engines such as http://pipl.com, which searches the deep web, or http://www.zoominfo.com/.

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Dealing with statistics

Many reporters have difficulty in understanding and using statistics. For a reporter covering science, health or HIV and AIDS, a basic understanding of statistics is important. There are a few questions that you need to ask when confronted with statistics.

1. What is the source of the statistics? Who published them?

   It is often important to name the organization that published the statistics, or the journal where they were published. This helps place them in perspective and establishes their authenticity.

2. When were the statistics released or published?

   In many areas and fields, statistics can become quickly outdated. Reporters should definitely know what is the period to which statistics relate, and it is often important to let audiences know as well. One such example is health statistics. When quoting HIV prevalence figures, the year is of critical relevance. In faster-moving situations such as H1N1 flu, you might want to specify not only the year but also the month or week or even the specific day. It goes without saying that an attempt should always be made to obtain the latest statistics.

3. Do statistics from different sources match each other, or do they vary widely? If they vary, why do they vary?

   Comparing statistics from different sources can reveal interesting facts. If there are differences between the figures from different sources, they should be carefully assessed – the reasons for the difference might be revealing.

4. What is the context for the statistics? Are they the result of a study? Who conducted the study? Who funded it? What were the questions

asked? What was the sample size? What were the other parameters of the study?

Not all of this needs to be conveyed to the audience, but it is definitely important that the reporter understand the context and processes that produced the statistics. The deeper you delve into the issues, the better you will understand the meaning of the statistics.

5. Check claims against statistics

   If a story or a claimed new discovery is not backed up by adequate statistics, be sceptical. Also, check if the text (of a press release for instance) matches with the statistics quoted – often, hyperbole and exaggerated claims can be spotted in this manner.

Once you decide to use statistics, these points should be kept in mind:

1. Statistics should enlighten, not confuse.

   Use statistics judiciously. Nothing turns an audience off as much as a long string of statistics. Ensure that statistics add to the point of the story, and illustrate that point, not overshadow it. Seldom are statistics worthy of being the main story.

2. What do the statistics mean?

   Interpret statistics and make them comprehensible to the audience. For this you will first have to understand them. It is useful to verify your interpretation with an expert to ensure that you are accurate and that you have not trivialized the matter.

3. Tell stories that bring statistics to life – look at what are their implications/ what they mean for the lives of your audience.

   It has been said that social statistics are "human beings with the tears washed away". The reporter can reverse this process for the benefit of the audience by relating the statistics to real life. Audiences are interested in stories about people, not statistics.

4. Restate statistics in simpler terms.

   Because the broadcast medium conveys a lot of information through the spoken word, statistics should be stated in terms that the audience can easily understand. For instance, if 77 per cent is restated as "more than three-fourths", the accuracy of the statement will be acceptable in most circumstances, and 79 per cent can usually be referred to as "nearly four out of five".

5. Use graphics, but judiciously

   On television, use graphics to convey information in a visually appealing and easily understood manner. Choose carefully which statistics you want to use; use those that are central to the focus of the story and illustrate certain aspects. Avoid using statistics just because they are there. Ensure that the graphics are to scale and are accurate.

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Dealing with scientists

Finding experts

The numbers of scientists and experts in different cities and in different countries vary widely. If you want to know how your country is faring in science and technology, see the report produced by the UNESCO Statistical Institute.[31]

If you find that the number of scientists per 10,000 people in your country is less than that of many other countries, it might be more difficult for you to find the relevant experts. But bringing out personal stories in science has more potential to motivate, create interest and to captivate your audiences. So, it is worth spending time and effort to see what scientists in your country are doing and report it or at least relate the findings from international studies to those that are being done in your country. The dejection of not being scientifically prolific is overcome by encouragement by media.

Stereotypes and archetypes

Man can't help hoping even if he is a scientist. He can only hope more accurately.

Dr. Karl Menninger

Quite often, the media presents the archetype of the scientist as a white-coated, bespectacled, absent-minded person who is sometimes not too aware of the ethical or social nuances of the world around him. But in reality, scientists are normal people – as normal as people can be. They may be egoistic, biased, narrow-minded and emotional. They may also be highly social and gregarious with high ethical standards. Some may have a very keen sense of humour and some others may not be affected at all by the best of jokes. If you can present a realistic picture rather than an archetype, your story will be more interesting.

31. http://www.uis.unesco.org/template/pdf/S&T/Factsheet07_No%20%205_ST_EN.pdf.

Presenting science as an activity pursued by normal people would also attract more young people to scientific research and, in the long run, your country too will have the scientific manpower it needs for its development.

Scientists may have a better than average understanding of their own discipline, but only a common man's understanding of other disciplines. No scientist can be proficient in all disciplines. So, you should limit the range of questions to the area of his interests and pursuits.

Preparing to meet scientists

> **I believe that a scientist looking at nonscientific problems is just as dumb as the next guy.**
>
> *Richard Feynman*

It is quite usual for people to assume that what they know themselves is common knowledge. They may also use technical terms in their day-to-day speech since they are quite comfortable with them.

When you talk to scientists, you have to make sure that they know how to break down the technical jargon to common man's speech or be able to present them in a context that makes them easily understandable. This means that you have to do some background work, reading up on the work of the scientist. A quick search on the scientist (tips to search provided in Chapter 19) will help you to be prepared in advance.

Besides scanning the previous papers of the scientist, you must take the keywords and do a quick search to see the status of current research in the discipline. You can avoid situations in which the scientist claims more than his due, if you are well prepared.

Using scientists

If you understand science, you can use scientists to inform, educate and entertain your audiences. But if you don't understand science and are awed by scientists, they will use you to reach across to the public to demonstrate how learned and scholarly they are and, in the process, make science look very difficult to understand.

Before you fix interviews with scientists, learn about their work and look for similes, examples and case studies that make their contributions explicit to the public. Before you start the interview, it would be wise to give some time to explaining that listeners and viewers may not be very knowledgeable about the subject matter and that there is a need to use simple language without too many technical terms.

If the scientist inadvertently uses technical terms, intervene and explain the term to the listeners/viewers.

If you are using radio as your medium, it is necessary to introduce the scientist and his credentials before you embark on the interview.

If you are using TV as your medium, take a series of shots of the scientist in his own settings – in front of the institute, laboratory, library or classroom – to make the introduction. This is useful to improve credibility and it increases the visual variety to make the programme more interesting. During the interview, make sure that you also super the name and designation. Do not super the introduction as soon as the scientist appears on a shot. A pause to make the viewers raise the question, "Who is this?", will help them to absorb the name and designation better. If the scientist appears again in another part of the programme, you will need to super the introduction again, since the viewers might have forgotten the name by then.

> **Science is a wonderful thing if one does not have to earn one's living at it.**
>
> *Albert Einstein*

If the scientist has to appear in different parts of the programme, it might be a good idea to use different settings for the interview – lab, office, house, restaurant, outdoors – because this will help to increase visual variety. If you are to interview the scientist in the studio, you could try and bring some props (properties) to help him demonstrate his ideas. A scientist explaining something with props will make the studio less dull and the scientist will be more at ease if he has something to do to dissipate the stress and tension of being in a television studio.

There are some scientists who are good at talking till the camera is switched on, when they suddenly become tongue-tied. Take a few shots before the actual shooting starts and let the scientist preview it. This will put studio novices at ease. They will understand that appearing on TV is no great shakes.

If you are using TV for explaining science, make sure that you do not depend only on the interviews of scientists – except when it is a theoretical topic. Experimental procedures provide a lot of action. This could be leveraged to improve the engagement and involvement of your audiences.

Quite often, the lab bench is against the wall. This could reduce the number of angles that you could take. See if you can get the workbench moved to a position where you can place the camera to cover the experiment better. If not, see if you can move the scientific instruments to a more conducive area for shooting purposes. If both do not work, you could consider using mirrors and shooting the reflection to get different angles. Be aware that reflections from mirrors turn left into right and vice versa. Sometimes, this can confuse the viewers, unless you establish the mirrors.

Ask the scientist about the experiment and the process. Break it down to one action per shot. TV is a medium of close-ups. So, play around with close-ups of action and take broad shots only to establish the context and to situate the action in the surroundings.

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Radio

After the emergence of television, radio has become a medium primarily for music. So, often, radio producers feel that communicating science is not possible on radio. Yet, radio – even the FM radio stations that play music 24 hours a day – can be used very well to communicate science.

For example, radio DJs are quite adept at talking about celebrities. Their illnesses, addictions, love affairs – these are topics that could be used to raise questions that involve scientific understanding. A few sentences about a specific illness, an explanation about what makes people addicted to substances, the why and how of love and romance – these are topics in which listeners would be interested.

Quite often, the lyrics of songs could be used to raise questions that relate to science. With modern technology, it is not difficult to use keywords and to parse the text of lyrics. Songs could be selected to bring out scientific topics.

(There are quite a few scientific songs at http://www.acme.com/jef/singing_science/, mostly related to astronomy and physics.)

You could also raise questions related to enjoyment of music. Is it only humans who enjoy music? Why do we respond to rhythm? Why do we like notes in the octave or the chromatic scale, notes well separated in terms of frequencies, when we can hear frequencies continuous from 20-30 hertz to about 20 kilohertz? How does music evoke emotions and images? Your audiences will love the titbits that you will be able to offer after you do your search and research as explained in an earlier section.

Not all radio stations are exclusively for music. If you are one of the lucky ones to work in an environment that allows broader content, and use scientists for interviews, consider a phone-in segment for your audiences after/during the interviews. This increases the involvement of the listeners. It will also provide questions that you have not prepared, leading to more spontaneity.

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Mainstreaming science

Most broadcasters in the least developed and developing countries do not have a specific scheduled slot for science. So, scientific information will have to be conveyed through other slots.

Politics

So, you have enough space to discuss politics in your country. You could start with the results of behavioural sciences. What are the cues for applause that politicians provide while giving a speech? Is a politician lying or telling the truth? How can you say from a recording of his facial expressions and eye movements? Is the smile of a politician a happy smile or a forced one? There are some interesting studies done on smiles, eye movements and facial expressions that could throw light on such questions and amuse your audiences.

Business

So, you have enough time to discuss business and economics. Then you have an opportunity to discuss scientific discoveries. Why do economies go up and down periodically? What are business cycles? Is it possible to forecast them? Scientific models can be applied to business models[32] when the premises are similar.[33]

32. A scientific model is a set of concepts and propositions, which, like maps, demonstrate the main features of the phenomenon being analysed. Often, a model will have some very restrictive premises that simplify the phenomenon in order to emphasize one or a few of its aspects (for example, ignoring friction in a physics model to focus on gravity), and these premises are later relaxed (friction is then added) to bring in some realistic complications after some conclusions have been made about the main features.

33. See, for example, http://www.foldvary.net/sciecs/ch01.html.

Sports

So, you are sports producer. You too can benefit from some basic science awareness. If you are comfortable discussing the physiology of muscles and bones, the pharmacology of performance-enhancing drugs or the aerodynamics of different types of balls, your audiences will lap it up and you will have an edge over other sports reporters.

Music

There are specialized TV channels for music and most FM stations depend on music to fill up time. Yet, think of how your audiences will react if you could discuss the science of music. Out of the continuous frequencies of sound, why does the human brain select some sounds as harmonious and others as discordant? Quite often, you could throw more light on the lyrics of a song if you were to dip into the scientific research being done. And when you are talking about celebrities in the musical world, you could have some interesting scientific points to make about their addictions, their health issues and even their love lives.

Cookery shows

What has cooking to do with science? And yet, have you ever wondered what makes rice soft when it is cooked? Why does the transparent liquid in an egg become white and hard when it is cooked? Why are some spices called nutriceuticals? What are their healing properties? In fact, the physical and chemical transformations that take place in cooking can enchant and engross the common man and woman.

Travel and tourism

Why should travel shows deal with only hotels and landmarks? Look at the details. Every place has its own kind of soil and if you knew a little soil science, a little about geological formations, something about the flora and fauna, you could make your show different from the run of the mill travel shows that abound in broadcast media.

Religion

Oh, so you are a producer of religious programming. Is there a God gene, which predisposes some people to spiritual and religious experiences? What is happening to the brain when somebody has a spiritual experience? What are effects of praying on the autonomic nervous system?

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Formats you could use

News

A news story is usually typically about a minute in length. It does not allow the reporter to provide adequate background information and in-depth explanations about the discovery. We have to stick to the basic minimum – five Ws and H.

The "Why" and "How" has to be formulated in a crisp, precise and accurate manner and here lies the main challenge.

Since news production does not allow the time needed to do adequate background research, you might not be able to provide the requisite background information to put the issues in context. So, you should do science news only after getting enough experience in producing science documentaries and accumulating deep enough understanding of a wide variety of scientific disciplines.

If I am to speak ten minutes, I need a week for preparation; if fifteen minutes, three days; if half an hour, two days; if an hour, I am ready now.

Woodrow Wilson

News also needs a "peg" – something new, immediate or having an impact on people's everyday lives: awards to scientists, an important person coming for a conference or seminar, an opening by a minister – anything that will help you to convince your superiors to allow you to cover it.

News stories need a focus and an angle. The focus, as the name implies, is the main issue covered in the story. The angle is what makes it news. It could be that a Nobel Prize winning scientist is giving a keynote address. If you know how to play with the focus and the angle, you can get away with covering conferences, which your predecessors could not hope to do, without the help of Internet research.

Features

Though, structurally, features are similar to news, they are longer and thus provide more time to provide the background and explanations needed to make a scientific advance understandable. However, most news editors/newsroom managers do not think that scientific discoveries are important enough to allocate five minutes in a bulletin. It will take strong pitching tactics to convince the news editor/producer. Start with why your audiences would be interested in the story and end with how it will improve the channel's ratings. As in any broadcast story, you will need to plan your pitch. However, when you make the story, your target will not be your editor/supervisor, but the viewers of your channel, and your story will have to be restructured to suit your target audiences.

Magazine

A magazine has a fewer number of stories per episode, though the total duration of an episode may be the same as a news bulletin. The length of each story may be as long as a feature. But the structure of the story could be very different. It allows a tangential approach to a topic, unlike a news feature, which has to provide information up front.

Moreover, the presenter of a magazine show has more flexibility. He does not have to be stuck in a studio setting. Gesticulating, moving around, use of props and even being present on location is allowed within the format.

You could have a magazine for health, another for agriculture, a third for environment, a fourth for technology and so on.

Documentary

This is the format that is most often used for science programming. Documentaries are often of half-hour duration (or more) and provide an opportunity to explore the background of the problem, create a context and delve deeper into scientific understanding of issues.

Documentaries need more in-depth research on content. When you do this, you become very familiar with the technical terms used by scientists and often end up thinking that lay people will also be able to understand them. So, you will need to re-examine your script for terms that do not occur in the everyday speech of your target audiences.

Structuring the content is the most important step in documentary production. Make sure that you ground your context in the information known to your audiences and move gently into areas that are yet unknown. Break up complex concepts into simple ones and deal with them first before presenting the complexity. Deal with specific issues (case studies) before generalizing. This goes against the academic training that you may have had, where the general principle is presented first and examples come later. So, this step is usually the most difficult for producers to follow.

When you are shooting for a TV documentary, make sure to get all the sync sound. Sights with synchronized sounds are more realistic and engage your audiences more. If it is a radio documentary, you have the flexibility of using location sounds to improve the quality of your programme.

Music has to be used very judiciously. So, do not use music only to make your programme more pleasant. Music could be used to provoke specific emotions, give clues about the space and time setting of your programme/ sequence, cue your audiences about the end or the beginning of a sequence and so on. In any case, do not use melodic patterns of music under the narration. It can distract musically oriented people from the content that you are trying to present.

Science in fiction

Science fiction uses quite a bit of established science as the basis and builds up from there. No wonder then that, quite often, we see that the imagination of the fiction writers become reality later.

Research has shown that audiences pick up scientific information subconsciously from fiction. So, when we inject science into fiction, be very careful that it is accurate. Inaccurate scientific information could mislead people – even though you are using a fiction format. The state of "suspension of disbelief" called forth by the fiction format, makes it easy for the viewers to find "scientific" explanations far removed from the real world.

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Investigative reporting in science

Science, by its very nature, is critical. But there are not many science critics even though film critics abound in media. This is partly because of the difficulty in plodding through scientific literature, which is full of terminology. While Galileo wrote in a manner that was easily understood by common literate people, Newton, who did not like to be criticized, made his works very inaccessible to the ordinary literate people of his times. The tendency to make academic work obscure on purpose continues since the man in the street interprets what is difficult to understand as scholarly. This is what the media has to fight against, by making science understandable to everybody.

The media is a watchdog for society and, therefore, there is a need to be critical of the scientific activity itself. On the one hand, the results of science can be used in developing technologies that are harmful to society and, on the other hand, there are unethical practices within the scientific community. The media should watch out for both of these.

Funding and research

Funding for research is mostly out of the taxpayer's contributions, but decisions about the flow of funds are out of the ken of ordinary citizens. What are the factors that determine the funding of proposals that come to the decision makers? Is there nepotism or corruption in decision-making? Do research proposals from a research group get funding in spite of poor research results from earlier funding?

If your country has a passed a bill for right to information, it is easy to access the relevant information.

The funding for scientific research could also come from the private and commercial sector. In such cases, there may be some vested interest to capitalize on the research outcomes. This can manifest itself in two ways. One is that the results are kept secret and not published so that a further development can be used to file a patent. The other is that the research is done to help promote the sale of products.

Keeping research results secret is justified on the basis of the argument that the expectation on the return on business investment is not wrong. Manipulating scientific research results for commercial gains is not as easily justified. In any case, while reporting science, you need to be aware of these possibilities. Keeping an eye on investments in scientific research is thus important. Funding through charitable foundations could sometimes obfuscate the real sources of funds and indirect influences on research results.

Ideology and activism

Quite often, the deep-seated beliefs of scientists can colour their research. Not accepting or even hiding data that may be contrary to beliefs is not uncommon. Discomforting data may be interpreted as an experimental error.

Publish or perish

Researchers are usually under pressure. Their career advancement depends on the number of publications they have to their credit. To increase the number of publications, the same research may be published with minor variations in different journals. So, when you interview scientists with hundreds of research papers to their credit, scan through their papers to see whether they are all the same wine in different bottles.

There is another technique that has evolved. Scientists may put in the names of colleagues who have nothing to do with the research. A larger number of authors improves the chances of publication on the one hand, and on the other, the scientist doing this would have gained credit with and the obligation of his colleagues who will, in turn, return the favour. It is a win-win situation. So, remember to check the contributions of co-authors.

If a scientist's work is quoted by others and the paper is cited in their references, it is considered to be influential. The citation index is thus a way of measuring the value of a scientific paper. This has given birth to the questionable tactic of citing not-so relevant papers just because they are authored by the scientist's friends. Again, the principle of "you scratch my back and I'll scratch yours" applies. So, you could check if there are cross-citations between scientists beyond reasonable levels.

The "publish or perish" principle has its extreme manifestations in plagiarism and in cooking up of data. Both plagiarism and fraud will of course be found out sooner or later. At least, that is what the history of science tells us. Yet, the temptation to indulge in both is great. Keep track of the works of the scientists in your country.

For links to organizations involved in investigative journalism, see: http://www.globalinvestigativejournalism.org/resources/organizations.html

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Pitching science stories

There are times when you want to cover a science story and your supervisor does not allow you to do it. This can take the wind out of your sails. To avoid disappointments, it is important that you prepare a bit before suggesting stories to your supervisor. Localizing your story is the first step. Science could be abstract and universal, but the stories presented in the media should anchor themselves to specific and local issues.

You may have to convince your supervisor about the impact of your story: Why should your audiences be interested in the story? So, you may need to dig up some statistics – statistics that you may not use in the story, but only in pitching the story to your supervisor. For example, if you want to do a story on diabetes, you could dig up the statistics of the number of people affected, the cost of medicines for a lifetime and so on to add weight to your argument.

The third angle that you could use in your pitch is to argue that your channel will have an edge over other channels by carrying the story. The kind of audiences that would be interested in the story could also be brought out. Getting audiences that are educated or well to do has implications in terms of attracting advertising revenue.

Once you have overcome the first obstacle presented by the media gatekeeper, you should focus your attention only on the second obstacle – the acceptability of your story for your target audiences. You may take a completely different approach to pitch your story to the public.

Pitching to traditional beliefs

If new scientific information is perceived to reconfirm traditional beliefs, there will be a greater amount of interest. Tradition can be used as a hook to link new information. For example, there is a traditional belief that in the rainy season, it might rain more on a new moon day. So, when you see a scientific report that the chances of precipitation (in ordinary language, rain) is more in the first quarter (from new moon to half moon) and third quarter (from full moon to half moon), take off on the traditional wisdom.

This may have a flip side, of course. There could be an illogical generalization by your audiences that traditional wisdom is better because “they knew it earlier than the scientists”. So, in such cases, it is better to end the story with unsolved questions. How is rain dependent on the phases of the moon?

Pitching it for broader acceptability

If possible, give information that is relevant for a larger number of people amongst your viewers and listeners.

For example, the Institute of Biological Chemistry in Kolkata was looking for treatments for leucoderma and psoriasis. They were using a specific variety of rats that developed white patches of hair, a condition that was taken as a model for leucoderma. The scientists there found that if they used a specific component of amniotic fluid, the hair of the rats turned back to a darker tone.

When we went to cover the story, we asked the scientists if we could keep it to the observables and say that it could be a treatment for graying hair. Many old people try their best to look young by using hair dye, some containing heavy metals, which are harmful. They could obtain the same results by using a natural product, with less harm to themselves and the environment. There are evidently more people with graying hair than people with leucoderma. So, the information could generate wider interest. The idea of the treatment for leucoderma could be used as a secondary focus of the story.

Pitching to provoke emotions

Scientific content is normally devoid of emotional content. That is why people find science uninteresting. Unless you can provoke emotions in people, your story will not be successful. A sense of wonder and awe is the easiest to provoke with science stories, but the possibility of provoking other emotions should not be overlooked. Search for a human angle, even if the story is on quarks or supernova – topics beyond lay people’s experience or even interest. Bringing in the scientist/innovator or people who are affected by the discovery or invention into the programme is of course the first step. But people by themselves do not provoke emotions. We will have to get into the agonies and ecstasies, the fears and foibles, the ambitions and animosities of the human world to get our audiences hooked.

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Problems that you could avoid

A big part of story telling is the suspension of disbelief. There are no questions asked in a fairy tale. But the essence of science is its critical spirit. An element of doubt about the truth or veracity of the materials presented is a necessary component of scientific discourse. So, scientists have a tendency to use the word, “may”, quite often. This does not fit into the language of the media where, effectively, the word, “may”, is changed into “is” or “will be”.

Quite often, producers use phrases such as “scientists think that”, “scientists believe that” and so on. This is not very precise because all scientists do not share the same thought or belief. In fact, there may be a few that have exactly the opposite thought or belief. If you cannot pinpoint a particular scientist who has the thought or holds the belief, you could say “some scientists believe that” or “microbiologists (or scientists working in a specific field) believe that…”. The best way, of course, is to name a specific scientist and the laboratory in which he is working. This makes the story more human and more precise. In fact, as we have seen, the best way to tell a story is to keep it personal and human, even if the topic is far from everyday human experience. Naming the scientist is therefore an important part of making the story more interesting to your audiences.

Exercise

It is better to learn from mistakes that have been committed by others. Visit http://www.guardian.co.uk/science/series/badscience to see examples of common mistakes media professionals make because of their lack of understanding of science.

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Language

Is, was, can, may, might, will, should, ought to, must...

These are words that occur frequently and we must pay proper attention to them.

In television, we normally tend to use present tense wherever possible. It creates a sense of immediacy. Though something has happened while you shot the programme, in the narration, you would use the present tense. The argument for this tendency of the medium is this: It is happening in front of your viewers now and, therefore, it is the present, not the past.

A scientist usually uses words such as "may", "might" and "could". Media professionals do not like to use such terms. We like to be more definitive. So, when a scientist says, for example, that global warming may happen, we might be tempted to say that global warming will happen. Though your audiences may not make any distinction, this interpretation of what the scientist has said might cost you loss of goodwill from the scientist. Scientists are not astrologers and they do not want to predict the future, especially of complex systems, where minor deviations in data may lead to extremely different futures. So, they are cautious.

Words like "should" and "ought to" are preachy. Avoid them as far as possible. The word, "must", is much more powerful than "should" and creates pressure for action. And the word, "can", creates hope, a possibility.

Be aware that these words have implications and, as words that are used very frequently, you must pay careful attention to how you use them till good habits are formed.

Relating to target audiences

"He"/"she", "they", "I", "we", "you"

The character of your story could be a specific woman or man. It could be a generalized "them". The possibility of using the first person singular or plural as the (seen or unseen) protagonist of the story also exists. Last but not the least, you could also use "you" while addressing your audiences.

Each has its use value. Please choose wisely. The voyeuristic pleasure of seeing somebody else's pain can suddenly become unbearable if you have to put yourself in his shoes. So, the distinction between using a third person protagonist and a second person singular becomes very important.

Similarly, you might use "we" to denote the citizens of a specific country. It helps to create a sense of solidarity. But when citizens of other countries see or hear your programme, they may feel excluded. In the era of satellite TV (or if you are using short-wave radio or digital radio), this is a pitfall that can be avoided.

The use of the first person singular also has advantages and disadvantages. "I" could make your story very personal and intimate. On the other hand, the assertion of the ego implied by the use of the first person singular could turn your audiences against your programme. So, you need to weigh the possibilities before using "I" as the protagonist.

The English language is very interesting. There are possibilities other than the words that are discussed in the above paragraphs. It is hidden in the above paragraphs. Can you find it? *(Hint: What impact does it have on the listener to use on "one" instead of " I" or "you"? One can do that, can't one?)*

Numbers

Scientists try to use language that is precise and logical. Broadcasters have to use language that is easily understandable and, if possible, endearing and enticing to the viewers/listeners.

So, broadcasters must understand the scientist's language on the one hand, but then use a language that is friendly to their target audiences on the other.

Here, we will reflect on the purely linguistic aspects of our respective crafts.

First, the use of quantities and units – these are bread and butter for scientists. But precise numbers are not easily recalled in broadcasting. Unlike in the print media, one cannot refer back to a figure that is mentioned in broadcasting. So, generally, producers tend to shy away from using numbers as far as possible. If numbers are absolutely needed, radio and television tend to round them off.

Scientists can get very upset when figures from their data are rounded off. We could say more than ten, instead of 10.35. The very thought that such inaccuracies in media should be left uncorrected rile them. So, it is always better to recheck the figures that are rounded off.

Percentages do not make sense to many people. Instead of 34 per cent, we could say more than 30 out of 100. Or better yet, nearly one-third. Again, we must double check that it does not distort the main points that the scientists want to convey, especially if you want their cooperation later for another story.

If you want the audiences to remember the number, try relating it to everyday experiences, or compare the numbers with similar figures.

Television has the possibility of supering the accurate figures. Since the audio and the text reinforce each other, dealing with figures is perhaps easier on television. It is not always necessary to put the same figures in audio and text. While the audio can round off the figure, the exact figure can be supered as text.

Even then, TV cannot compete with print in giving accurate figures, which the reader can pause over, reflect on and come back to reading or go back to later.

The temporality of TV and radio are thus somewhat restrictive.

However, this does not mean that TV and radio producers do not use numbers. In fact, numbers give credibility to a report. So, quite often, when numbers are used, it is not with the intention that the target audiences will remember the figure after the programme is over, but to make the report look more authentic and the study being reported more rigorous.

(Interpreting figures from statistical studies is yet another skill that not only science and technology producers/reporters, but all media professionals, must master. Since this issue requires attention, another section is devoted to it later).

Quantity

Quantities are not represented by numbers alone. Quite often, there is a unit associated with it. You will have to pay special attention to the units that follow the number. You may need to translate the units into contemporary spoken language in some cases, even if this means spending some time to do so. This is the other reason why radio and TV producers try to reduce the frequency of figures in their reports.

Reference to quantities

"Some", "all" and "a few" are all commonly used and easily understood terms. But there is a tendency to exaggeration and loose expression amongst the lay public. So, if you hear somebody saying that "all politicians are corrupt" and, later, that some of them are honest and transparent, the listener may accept the internal contradiction. But in the media, this would be unforgivable. The word, "accuracy", has a different meaning for media professionals. Rounding off numbers may be acceptable, but creating wrong impressions and passing off opinions as facts are not.

For example, many media reports carry the phrase, "Scientists believe that…" This implies that all scientists have the same belief. Factually, this may be incorrect. There might be a few or even one that disagrees. A quick literature search might bring out the dissenting viewpoints. Double checking is necessary.[34]

"Many", "some" and "a few" bring down the numbers progressively in the listeners' mind. Even with these terms, the tendency for generalization cannot be overcome. So, it is always better to put forth a specific case. "Professor XYZ from ABC Laboratory in this city" is better than a loose reference to "scientists".

Time

Time is an important component of story telling. So, besides "before" and "after", we have words such as "later", "soon" and "subsequently". Separately looking at the words that have connotations of time in your language is a very useful exercise.

Time is also a main component in the concept of causality. "Consequently" and "subsequently" are both terms that have a dimension of time in them. But while "subsequently" refers to only the temporal component, "consequently" has a largely causal relation embedded in it.

Logic

Logical flow of information is easier to grasp than seemingly disparate and discrete pieces of information. In ordinary language, there are many logical connectives like "so", "therefore", "but", "however", "yet", "though" and so on. Learn to use these connectives so that the information you provide holds together as a unit, rather than as separate pieces.

34. This in fact is useful if you are using the story-telling style. The protagonist and the antagonists are both useful characters in a story.

Dictionaries and resources

The technical terminologies used by scientists are quite often taken from Latin, Greek or some other language. Sometimes, scientists combine words to form compound words (for example, atherosclerosis, arthropod). There are also words that mean very specific concepts or things in a particular discipline, but mean something else in ordinary language (for example, the concept of work in physics).

Translating the polysyllabic vocabulary of the scientists to simpler shorter words and ideas comprehensible to lay people is one of the main challenges that a science broadcaster has to face. Dictionaries are of great help here. There are many speciality dictionaries on the Internet. Visit some of these and bookmark the ones that you find most useful. Try these:
http://hyperdictionary.com/medical
http://www.ibiblio.org/collection/collection.php?primary=8
http://www.yourdictionary.com/diction4.html
http://dictionary.babylon.com/science
http://www.alphadictionary.com/directory/Specialty_Dictionaries/

There are scientists who use fancy names for new discoveries in the hope that it may catch the popular imagination. (Quark in particle physics was taken from Lewis Carroll's hunting of quarks. The blue elves and red sprites in atmospheric science are other examples.) This may pose another problem since your audiences, which are highly literate, may interpret meanings from their previous exposure to such words. Explanations for the meaning of words may become very important in such cases.

Editing your language

Scholarly communication abounds in long sentences. In fact, scholars make it a habit to write long and difficult to read sentences. But the media needs to use short sentences. If the average sentence in your script is more than seven words per sentence, you need to rework your script. The length of sentences has to be kept as short as possible. Since both radio and television use spoken words, rather than written ones, the normal rules of grammar and sentence structure do not apply. You could put a full stop after a word. For example, you could start a script like this:

"Kuala Lumpur. The city of twin towers. …". It is not necessary to say, "This is Kuala Lumpur" or "We are here in Kuala Lumpur" or " The city is famous for its twin towers".

So, after you have written your script, see if you can put a full stop after every word, if that is not possible, see if you can put full stops after every phrase. This exercise will make your script less wordy.

There are two questions that you need to ask when you are editing your script.

1. Is it necessary? Ask this question about every word and sentence. You may be able to cut off quite a few words, saving quite a few frames and seconds in your programmes, while making it "pacy" and slick.
2. Is it sufficient? This question has to be asked after the first question has been asked. This is to make sure that your programme has all the necessary information to make the ideas presented comprehensible. Ask the question on each sequence (or paragraph). Addition of a word or a sentence could sometimes make an idea crystal clear to the listeners/viewers.

The exercise will make your script precise and brief. The pause that is needed for this exercise will call forth questions that improve accuracy.

Acronyms

Acronyms can save quite a few frames and seconds. But quite often, your audiences may not understand acronyms. So, in general, acronyms are to be spelt out in full, except in cases where they are easily understood, as, for example, in HIV, AIDS, UNESCO, UNICEF.

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Useful links

Meeting grounds for science and media

A website that gives policymakers, researchers, the media and civil society information and a platform to explore how science and technology can reduce poverty, improve health and raise standards of living around the world: http://www.scidev.net/en/. This website also provides an online course in science journalism.

For science news alerts, see http://www.eurekalert.org/, an online, global news service operated by AAAS, the science society, which provides a central place through which universities, medical centres, journals, government agencies, corporations and other organizations engaged in research can bring their news to the media. Scientists and public information officers of science laboratories reach out to science journalists through this website. So, it is easy to get scientists to cooperate with you for your story.

http://www.alphagalileo.org/ is an online service for the best of European research news in science, medicine, technology, the arts, humanities and social sciences. It provides access to press releases, event details, publications and broadcast media reporting on recent developments in European research.

http://www.journaliststoolbox.org/archive/science-resources/ : the site provides science resources for space and astronomy links and information, science news sites, locating researchers/ organizations/ experts/ agencies, international science sites and miscellaneous science sites.

http://www.nieman.harvard.edu/reportsitem.aspx?id=101279: A site with science articles written by journalists, which works with a network of faculty members at journalism schools, who alert colleagues and students about the contents of each issue.

Here is a list of websites that may be of use to science writers in locating news releases, news tips and the latest science news, research centres for science coverage and analyses, which universities, medical centres, journals, government agencies and corporations can bring their news to the media and public: http://www.nasw.org/resource/general/.

Sometimes, scientists do turn to broadcasting. You can find some good examples of this in: http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/1260/science_broadcasting_feature_index.

A guide for public information officers, scientists and physicians (classifying the different types of media, the steps and procedures taken to tell your story, media arrangements at scientific meetings, and the downside to reporting science news). A look at the issue from the other side: http://www.nasw.org/resource/pios/csn/index.htm

A community where science lovers can share the latest news that explain the latest science and technology research in a way that lay people can understand it and relate it to their lives and world through videos uploaded by ScienCentral's independent news bureau: http://www.sciencentral.com/video/.

http://jcom.sissa.it/archive/ is an open access journal on science communication and is a platform where distant communities can meet: academic scholars, journalists, museum operators and scientists who live and work in fields where theoretical reflection and concrete action are strongly intertwined.

A Guide to Careers in Science Writing: http://www.casw.org/booklet.htm.

Science writers' associations

There are many associations of science writers. Some associations may insist that you become a member before allowing you to use their resources. But the ones below allow you to learn from their common resources, though you may not be able to take part in the discussions.

A membership association including media professionals, communications officers in science and technology institutions, technical writers and educators dedicated to fostering quality science communication, linking science and technology communicators from coast to coast and increasing public awareness of Canadian science and technology, especially among the youth: http://www.sciencewriters.ca/.

Council for the Advancement of Science Writing comprises a panel of distinguished journalists and scientists committed to helping reporters and writers produce accurate and informative stories about developments in science, technology, medicine and the environment: http://www.nasw.org/users/casw/.

The Association of British Science Writers helps those who write about science and technology and works to improve standards of science journalism in the UK: http://absw.org.uk/.

The International Science Writers' Association, an organization of individual members, serves as a means for science communicators everywhere to share in the mutual benefits of a professional organization and serves as a bridge between scientists and communicators on an international scale: http://www.internationalsciencewriters.org/.

The World Federation of Science Journalists, a non-profit organization representing 40 associations of science and technology journalists from Africa, the Americas, the Asia-Pacific, Europe and the Middle East, seeks to further science journalism as a bridge between science, scientists and the public and to promote the role of science journalists as key players in civil society and democracy: http://www.wfsj.org/.

http://www.scienceonair.org/ is an informal network of science radio programmers, science radio journalists, researchers and scientists interested in radio as a medium for science communication.

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Process and Acknowledgements

Research

First, in order to understand the broadcasters' take on science and technology, a questionnaire was administered to broadcasters in the Asia-Pacific region. From the response to the questionnaire, it is seen that none of the broadcasters have producers who are trained to cover science and technology. In fact, quite a few broadcasters admitted that they do not have producers who have a degree in science.

Some broadcasters do cover science. Since the producers are not trained to cover scientific content, what is seen frequently is news that does not explore the content in depth. Interviews, which do not call for the producers' mastery of the content, are the most common format. Other formats used are documentaries and magazines.

Quite a few countries in the Asia-Pacific region are agricultural economies. Some of them have daily shows on agriculture. Again, studio-based interviews are most common. Health and environment come next in the common topics covered.

The broadcasters felt that technology, especially information technology (IT), is an important area. Social and behavioural sciences were identified as another priority area. Some broadcasters felt that it was necessary to build the capacity of the producers to enable them to cover all areas of science.

Consolidation

As the next step to the production of such a kit, an expert group was constituted to come up with suggestions on content and style.

The expert group consisted of:

Dr Martin Hadlow, Associate Professor and Director of the Centre for Communication and Social Change, School of Journalism and Communication, University of Queensland, Australia;

Dr Madeline M Suva, Associate Professor and Chair of the Development Journalism Department in the College of Development Communication, University of the Philippines, Los Banos, Laguna, Philippines;

Mr Nalaka Gunawardene, Director and Chief Executive Officer of TVE Asia Pacific, a regional media foundation engaged in communicating sustainable development and social justice through television, video and the web;

Mr Killugudi S Jayaraman, India correspondent for Nature and pioneer of investigative science journalism in India; and

K P Madhu, Programme Manager, AIBD, who was actively involved in science communication through television for more than 20 years.

The expert group, which met in Los Banos, consulted many local experts from the University of the Philippines Los Banos: Prof. Aleli Domingo of the Institute of Mathematics, College of Arts and Sciences; Dr Wilfredo C Cosico, Soil Science Cluster, College of Agriculture; Prof. Ivan Marcelo A Duka, Institute of Biological Sciences, College of Arts and Sciences; Prof. Raymundo B Mendoza, College of Human Ecology; Dr Serlie B Jamias, Head of Department of Science Communication; Prof. Luningning A Matulac of the Department of Educational Communication; and Dr Benjamina Paula G Flor of the College of Development Communication.

The expert group had the following suggestions:

1. The expected users of the training and resource kit are primarily reporters and journalists working in radio and TV. Supervisors and managers of the producers/reporters/journalists may also find the resource kit useful. If the resource kit proved to be useful to print journalists and students of mass media, it would be an added benefit. Scientists who would like to report or popularize science could also find some sections useful.

2. The kit should consist of printed material, a handbook containing the essential information. Printed materials are easily transported and accessible to those who may not have computers and Internet connections. The material will be made accessible from the AIBD website as a downloadable PDF file.

3. Printed material cannot be revised or updated easily. So, the material will also be made available as WebPages, which are frequently updated.

4. Access to the Internet is not easy or affordable in some contexts. Hence, the contents of the WebPages will be made available in the form of CDs to participants of workshops on science programming and production. This is to facilitate easy access to relevant information for people who may have computers, but do not yet have Internet connections.

The recommendations for the contents of the kit was posted on the AIBD website and sent to more than 100 producers for their comments and suggestions.

Pre-testing

A draft was prepared based on all these inputs. The draft was used as the basis for conducting a workshop on Science Reporting in Kuala Lumpur. The participants – producers from radio and TV organizations – had no previous experience in Science Reporting. The reactions, feedback and inputs from the participants were used to add, rearrange and revise the contents.

The revised draft was sent to producers who had previous experience and expertise in the production of programmes related to scientific topics. The draft was revised on the basis of their inputs, suggestions and criticism. Then it was used in another workshop – in Sudan. Minor changes were made again.

The contents of this book available as a web version will be constantly updated and upgraded. So, your inputs for further improvements are welcome.

End Note

Intenet is a rapidly evolving platform. The sites mentioned in this book may change, disappear, add new features. Many new sites will appear which are equally or more useful. You could add to this resource kit. Write to us.

Broadcasting **Science**

In spite of the fact that science and technology have great bearing on the day-to-day lives of people today, broadcasters do not seem to adequately cover science and technology. This book is an attempt to build the capacity of broadcasters to report and cover scientific topics. It contains two parts. Part I is a general introduction of science to broadcasters. Part II deals with use of scientific information in broadcasting.

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