PG JMC S4-02 (DSC)

TWO YEAR MASTER'S DEGREE COURSE
(CBCS in Accordance with NEP 2020)

SEMESTER IV

SCIENCE COMMUNICATION

JOURNALISM AND MASS COMMUNICATION

Bhupen Hazarika School of Mass Communication

KRISHNA KANTA HANDIQUI STATE OPEN UNIVERSITY

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March, 2025

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Printed and published by Registrar on behalf of the Krishna Kanta Handiqui State Open University.

The University acknowledges with thanks the financial support provided by the Distance Education Bureau, UGC for the preparation of this study material

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Meaning of Health Communication- Community Medicine, Communication for Health Initiatives of WHO; Health communication issues related to the field of medicine; Delivery of healthcare ; Sources of news on health issues- Health Literacy; A brief history of Physician-Patient communication; Communication strategies of NRHM; Interpersonal dimensions of health communication; Environmental health; Environmental Communication- Meaning and Definition , Areas of Environmental Communication, Some important environmental issues

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Media Laws & Ethics ; Laws related to Science ; Awards for Science Communication

COURSE INTRODUCTION

In this course we are going to discuss the basic concepts on science communication. A good and clear concept about science communication is necessary for inculcating scientific temperament among the common people as a journalist or communicator. Once you complete this course, you will have developed a clear idea about the science communication.

This Course is divided into fifteen units which are as follows -

UNIT - 1 : BASICS AND HISTORY OF SCIENCE COMMUNICATION

This is the first unit of the course on 'Science Communication'. In this unit, you shall come to know about the emergence of modern science, history of science journalism (global context), history of science journalism in India and the need and significance of science communication in the present day context

UNIT - 2 : BEGINNING OF SCIENCE COMMUNICATION IN INDIA

This particular unit deals with the beginning of science communication in India - the contribution of print media, radio , and television . This unit also talks about the science communication movement in India and the history of science journalism in India

UNIT -3 : SCIENCE COMMUNICATION IN ASSAM

The third unit of this course describes the beginning of Science Communication in Assam which covers the Pre Orunodoi era, Orunodoi era and Post Orunodoi era.

UNIT-4 : SCIENCE WRITING

This unit will introduce you on how one should write science based news (inclusive of science features an articles). This unit will also give a brief overview of the different sources of scientific information and the qualities of a science news reporter .

UNIT- 5 : SCIENCE AND TECHNOLOGY POLICY IN INDIA

The fifth unit of the course basically talks about the different science and technology policies in India like the Scientific Policy Resolution of 1958, Technology Policy Statement of 1983, Science and Technology Policy 2003 and the Science ,Technology and Innovation Policy 2013

UNIT - 6 : SCIENCE AND TECHNOLOGY SET-UP IN INDIA

The sixth unit of this course gives an overview of the Science and Technology System in India including the different departments/ministries/councils at the Centre and the State and other recognised in-house R & D units

UNIT-7 : SCIENCE COMMUNICATION MEDIA

The seventh unit of the course looks into the different media for science communication like print media ,audio-visual media, folk media and interactive media

UNIT-8 : SCIENCE POPULARIZATION PROGRAMMES

This is the last unit of the first block whereby the different science popularization programmes have been death with. Moreover, the role of various institutions like CDAC, NCSTC and Vigyan Prasar in this regard have been discussed at length.

UNIT - 9 : SCIENCE COMMUNICATORS

This unit will introduce you as to who is a science communicator as well as various training avenues for science communicators

UNIT - 10 : PUBLIC UNDERSTANDING OF SCIENCE

This unit explores the need for public understanding of science and technology and also emphasizes the role of communication in this regard.

UNIT -11 : SCIENCE COMMUNICATION FORMATS

This unit will throw light on the various science communication formats and also the strengths and weaknesses of the different formats

UNIT-12 : WRITING AND REPORTING ON SCIENCE

This is the twelfth unit of the course and it describes the process of writing Science Communication and also discusses the writing of Features and Articles on Science

UNIT- 13 : PREPARING BROADCAST MATERIAL ON SCIENCE

In this unit, you will get an overview of the various formats of Radio Programmes and also the important points to be kept in mind for writing for radio and television on science

UNIT - 14 : HEALTH AND ENVIRONMENTAL COMMUNICATION

This unit will make you understand the basics of health communication and its growing significance in the present-day world. It will also focus on the importance of environmental communication in the society

UNIT-15 : LAWS, ETHICS AND AWARDS FOR SCIENCE COMMUNICATION

This is the last unit of the course. This unit intends to focus on the laws and ethics related to the field of science communication. It will also delve on the different awards that given in the field of science communication.

While going through this course, you will come across some along-side boxes, which are put on the left side or right side of the text. These boxes will explain you meaning of some words and concepts within the text. Apart from this, there will be some broad and short questions which have been included under 'Activity' and 'Check Your Progress' in every unit. Activities will increase your thinking capacity because questions put in Activity are not directly derived from text. Answers to the short questions have been put under section 'Answers to Check Your Progress'. Besides, a few text-related questions have been put in 'Possible Questions'. These questions will help to draw your attention on the probable topics for the examination so that you can prepare for the examination with confidence.

UNIT 1: BASICS AND HISTORY OF SCIENCE COMMUNICATION

UNIT STRUCTURE

1.1 Learning Objectives

1.2 Introduction

1.3 Emergence of Modern Science

1.4 History of Science Journalism (Global Context)

1.5 History of Science Journalism in India

1.6 Need and significance of science communication

1.7 Its importance in present day context

1.8 Let Us Sum Up

1.9 Further Reading

1.10 Answers to Check Your Progress

1.11 Model Questions

1.1 LEARNING OBJECTIVES

After going through this unit, you will be able to :

- understand the emergence of modern science
- analyse the development of science journalism at the international and national levels
- discuss the present-day trends in this direction
- explain the significance and need of science journalism in the modern day context

1.2 INTRODUCTION

In simple terms 'Science' is the study of various aspects of the world and the universe in a scientific, rational and logical way where nothing is left to assumption. Rather, everything is established only after a series of thorough experiments and investigations applying established norms and standards. These scientific findings are applied for improvement of standard of living of people in all walks of life by utilizing them through improvised

devices or systems for development of humanity. Hence, science is an integrally-important part of our life. These days, since the times of the emergence of modern educational system, there are so many institutions of academic and research-orientation. They are engaged in scientific studies being carried out into different innovative and futuristic areas of human beings. And, subsequently a very big storehouse of knowledge in all these and also many frontier areas have been accumulated over the decades. This would also remain so in the near as well as distant future. Now, unless these research findings are taken out of the laboratories and applied in real life for betterment of our life they would not have any proper value. Herein lies the significance of science communication of which science journalism is a major component. That is because, for reaching out to the mass people at every level of the society across the world, it is one of the topmost convenient and reliable media. Thus, science journalism needs to be studied and practised in detail for the cause of making the people aware of various developments in the field of science, thereby inculcating a sense of rational and logical lifestyle to the optimum possible extent. This is such an important activity that even the UNESCO has instituted the Kalinga Prize for Popularization of Science in 1952. The National Council for Science and Technology Communication (NCSTC), Government of India also awards several prizes in a few areas of science communication every year. The primary objective is to encourage people to adopt it and strive for converting maximum people oriented towards this aspect.

1.3 EMERGENCE OF MODERN SCIENCE

An article by a prominent researcher in this field in the British Journal of History of Science (BJHS) says that there has been divergent views about it. One school opines that it began in the high middle ages (1277 to be precise) or with 'via moderna' in the 14th century. Also, a more widespread view is that with the Italian Renaissance, it was the 're-birth' of the sciences. (Oxford University Press, January 5, 2009). Further, generally Copernicus is considered as the great science revolutionary and the scientific revolution is supposed to have taken place in the period of Copernicus to Newton.

Another view is that science revolution took place in the 7th century from Galileo to Newton. You shall have to study various documents available in different sources in this regard to realize the significance of this revolution and emergence of modern day scientific knowledge base.

A very important and relevant point here is that this revolution has opened the ways people started looking at the various issues of life including the belief of the sun rotating around the earth, centrifugal force, healthy way of life based on a hygienic system etc. So, peoples' attitude also changed to a big extent. Industrial revolution, better health awareness, education, availability of knowledge in the form of books after invention of printing press, modern means of travel including aeroplanes, communication means like radio, TV and of late internet etc. have brought in a major ease in the living of life in the society.

However, even in today's time, a certain section of the global population live in 'not so hygienic' way, having biased viewpoints about basic truths of life etc. Hence, communicating the proper knowledge systems to this particular target audience is quite important. And here science journalism is the most important means of getting those messages to the right kind of people without major wastage of time and resources. Most of you have already experienced yourself how the country had to undertake the Swachchata Abhiyan a few years ago to inculcate the very basic aspect of cleanliness in our life.

Many dedicated people including scientists, researchers, health professionals have been engaged in furthering this cause since a long time now.



CHECK YOUR PROGRESS

Q.1: Why does science need to be communicated ?

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Q.2: Is there any connection between science and improvement of our living standard at all ? How ?

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Q.3: How simple is it to find out the period of emergence of modern science ? Why ?

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Q.4: What is science revolution ?

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Q.5: What is the relation of Copernicus with science ?

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1.4 HISTORY OF SCIENCE JOURNALISM (GLOBAL CONTEXT)

An article in 'Nature' in June, 2009 says that science journalism began around 120 years ago. It started when in the absence of any proper science journalist, the famous science fiction writer HG Wells started the good work of writing newspaper articles on different aspects of science. Wells initiated writing several important science fiction contents like 'Time Machine'. He had launched a lot of efforts to develop "translation of scientists' jargons and use writing techniques to engage non-specialists (common people)." The same article also informs that in 1904 The New York Times appointed Carr Von Anda as a science journalist and he did a meticulous and commendable job during his tenure. In the 1930s and 40s, several science journalists supported by scientist-researchers made efforts for convincing the people in general that adoption of a scientific way of life

would bring about a lot good for the society. It was in 1934 that the National Association of Science Writers (NASW) was formed in the USA. George W Gray of Time in 1937 opined that science journalism needed to inculcate awareness about making scientific methods an integral part of popular education and through it a universal element of civilized thinking" (Rensberger, 2009).

With such humble beginnings, the discipline started evolving properly to arrive at a matured status of late. Today, a good number of journals (like the Indian Journal of Science Communication), TV and Radio programmes, blogs are produced all over the world on various aspects of this discipline.

1.5 HISTORY OF SCIENCE JOURNALISM IN INDIA

India has a rich tradition of communicating scientific findings and aspects to the people in different ways since ancient times. The Vedas, samhitas and many other epic-like books can be termed as attempts to communicate various basics of knowledge to the mass people down the emerging ages. It is also true that many of these efforts need to be re-examined in terms of their relevance in the present day era. Yet during those times when they were conceived and prepared, they can be fine examples of communicating scientific principles to the masses. Cutting back to the modern times, it was Digdarshan, the first monthly magazine in Hindi, Bengali and English to have regular news items on science. Hence, this can be cited as the first modern science journalism initiative in our country. Similarly, the first newspaper in Assamese and the present North-Eastern Region of India – Orunodoi (launched in 1846), also a monthly, carried science news. Even though it declared itself as a newspaper dedicated for spreading of Christianity, it had often contained science-related news items.

Against this background, the current scenario of science journalism is not a very encouraging one. That is, there are quite a few proper science journals which are not aimed at the general public. But popular newspapers or magazines dedicated fully to this theme are very rare. It is a hard fact that for most of the newspapers and magazines, coverage of science-related issues is not exactly a priority. But, despite this, *The Hindu* dedicates a full

page every week for coverage of some specific aspects of science and technology. Similarly, its sister publication *The Frontline* also publishes short items on latest development in this field in every issue of the fortnightly magazine.

At the same time, in spite of a not-so-encouraging scenario of science journalism in the country, several noteworthy efforts have been taken up continuously for promoting this aspect. For example, there is the Indian Science Communication Society (ISCOS), based at Lucknow since 1978. It has been organizing a training course in science journalism and science writing for interested people in this field. It has also been publishing a popular science magazine termed Indian Journal of Science Communication for about two decades. This journal has been disseminating various aspects of science to the people in a language that is simple and understandable to a large extent. Besides, many state-level voluntary associations of science have also been publishing journals and magazines in this direction. Science Reporter from VP is another example. Similarly, Bijnan Jeuti from Assam Science Society is one long-serving journal in this regard.



CHECK YOUR PROGRESS

Q.6: When did science journalism emerge in the world and also in India ?

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Q.7: Who was George W Gray ?

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Q.8: Does any newspaper / magazine in our country have science communication contents on a regular basis ?

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Q.9: Which organization in the voluntary sector provides science journalism course ?

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1.6 NEED AND SIGNIFICANCE OF SCIENCE COMMUNICATION

From the above discussions and from other sources, it can be concluded that science is the basis of life and also the primary requirement for maintaining a rational and logical standard of life in this world. Each and every step and walk of life needs a scientific basis for progressing towards a positive development. Hence, science is so important for our life. This includes both basic or physical sciences and social sciences and humanities. Here the basic question is - how would the people - the target audience of the communication receive the messages which are supposed to be empowering for their life. In other words who would act as the mediator between the sources of the science knowledge base and the masses.

So we need science journalism or communication for fulfilling this purpose.

A journalist or professional communicator interested in this field would need to go ahead with the following process for discharging his or her duties -

- First of all they need to look for potential sources for news on science and related areas - new discoveries, their possible applications for uplift of human life or furthering knowledge,
- Develop a working relationship with the sources so that the latter can inform the former about these new developments
- Then prepare those findings or innovations in a language which is easily understandable to the common people

- Many a times when a crisis situation may arise in the society like the COVID-19 pandemic, spread of 'false and mis - information', relevant sources in those areas would have to be contacted and request them to offer their voice or views and dispel the 'lack of truth' in that direction so that people can be empowered

These are the basic steps needed to be observed for communicating scientific news and information for the greater interests of the people.

Let us discuss a few examples which shall make the scenario a bit clearer. There is a provision of extension officers at Block Development Office level of the country for both agriculture and veterinary departments. The primary job of these officials is to reach out to the farmers at grassroots level. The idea is to make them aware of the latest development in these fields so that these can be adopted for better yield. Yet, how much of these efforts are actually happening in reality ? Similarly, if a Civil engineering department of an established educational institution has developed a new mechanism or technique for construction of a better building or house, that needs to be communicated to the people. As a result they can be adopted to develop a better construction for future.

Even in case of the COVID 19 situation there was a scope to make people aware of a solution of preparing sanitizers in a do-it-yourself manner at their homes only. That would have been highly helpful for people. Here also, science journalism can do a lot.

We can see that a good portion of people of the society usually do not like to adopt a new system or technology when it is introduced in the initial period. But it has also been found that this particular system or technique is productive and supportive of human efforts in that specific area. So, disseminating news and information and scientific developments of the world is indeed a primary job. But there is an urgent need also for picking up and publishing success stories in those areas. This is to ensure that those people who would not like to use or adopt them are encouraged to adopt the same and thereby make their life better.

At this point, the communicator also needs to keep in mind the language to be used for this purpose. This is because this language has to be understood by anyone and everyone as far as possible.

The issue is further made difficult by the fact that many a times or more often than not, an innovator or scientist or researcher is usually not a good communicator. Thus, the science journalist has to first understand the basic principles or working system of the new findings or developments and then write in a common man's language for publication.

In this direction, preferably TV and Radio score better than print medium as the first two can show a demonstration of the new developments in a 'live' situation. This obviously can be more attractive as well as effective for human beings.

Besides, the following points need to be observed without fail while discharging their duties as a science journalist ---

- Facts and figures must be accurate and to-the-point. Otherwise this shall be equivalent to providing misleading information that may prove harmful at times
- Attribution or quoting of sources must be correct or a chaotic situation shall arise
- By developing a strong sense of observation and analytical power, a science journalist must be able to link different phenomena happening around the same time to something basic in the field of science and technology thereby making people aware about the root cause of this problem

Where to locate sources

A certain amount of home work is definitely necessary in this field in the initial period. That is - looking for recent science findings in different laboratories in and around the society or somewhere else. In this regard, the journalist concerned needs to keep one's eyes and ears open for any such possible news item in any media or source. Following that, one must try to access the websites of those organizations for further confirmation. This is a very positive development. That is, nowadays, any decent organization, whether engaged in academic research or stand-alone research activities must have a reasonably good website for showcasing many of their findings and areas of research. Even those engaged with

defence-related issues also do have websites by disclosing things to the extent possible for not compromising on their secret mandates. So, a proper study of the websites of such institutions and organizations would allow further details on many of those news items. Of course, the question of copyright and patent would also matter.

Thus, after getting a hint from a brief news item or a casual talk or conversation with scientists or other sources, the science journalist must decide whether it would be interesting or not. And more than interesting, whether it would be beneficial for the people in the short and long run. Your journalistic instinct or 'nose for news' capacity would also be highly helpful in this direction. Following this, there are mainly two choices. A science journalist can write a print medium news story or feature. Alternatively, prepare a TV / Radio news item from the already available facts and figures in those websites depending on the targeted audience. On the other hand, many a times these additional information may not be openly available or accessible. In those cases, one can approach the officials of those institutions and request for a briefing from the right person - an authority in that particular area for an interview and scope for a broader news item.

It needs to be mentioned here that nowadays, the governments - both at the Centre (Delhi) and states are highly media savvy. Also, because of a popular dictate they want the public-funded organizations and institutions to publicise and open up their knowledge base for public viewing. The idea is to enable people to access them properly and take their due advantage whenever and whichever ways they can visualise.

Let us see these examples for such a purpose---

- The Indian Institute of Wildlife, Dehradun brings out a highly professional and exhaustive State of the Indian Forests Report every two years. This report is the ultimate authority in these matters and contains many useful information including increase and decrease in different types of forests cover in the country
- The websites of Bureau of Police Research and Development (BPRD) and National Crime Records Bureau (NCRB)provide some

interesting records of crime and newer developments in the system of policing in the country. These can be used for making awareness among the people.

These are just minuscule examples of institutions and organizations involved in science-related areas keeping their findings in the public domain for popular benefit.

It is not that the websites are the only good sources of any science news. These can also come under any source across institutions including academic ones like universities, colleges etc. which may not always be found on the website. Similarly, annual reports of these organizations, institutions are also other potential sources of science news.

1.7 ITS IMPORTANCE IN PRESENT DAY CONTEXT

The importance of science journalism for the society shall remain high for the foreseeable future. We can see that despite so much of advances in each and every area of science and technology, a good portion of the society all over the world still remains poorly aware of many of the developments in this field. But these aspects have the potential for safeguarding their lives and also improving their standard of living if some of these developments are adopted on a day-to-day basis.

The COVID-19 pandemic has amply shown us one important aspect- the ground-level awareness of many of the people in the world is still at a lower level. Thus, they would not like to adopt any preventive measures like wearing of masks, maintaining social distance in public, taking vaccine etc.

At this point, science journalism is among one of the topmost effective methods or ways for informing people of the downside of those habits. This is because the goal and final responsibility of journalism and for that matter any communication system or method does not end simply by delivering or disseminating information from all fields to the people. It is also the responsibility of those communication initiatives to influence the target audience. And as far as possible convert them to such an active awareness level that the people are compelled or driven to practice whatever is being disseminated to.

In other words, every communication effort, whether it is journalism, audio-visual programmes, blogs, podcasts, there should be only one end objective. That is - to empower the receivers of those information in such a way that they become empowered to practically utilize that portion of knowledge.

While trying to achieve this goal, the effort needs to follow the 7 C's of communication -

Clear - There should not be any double-meaning aspect in it with only one simple meaning disseminated .

Concise- Not too long or too short, just enough to elicit interest, receive and be inculcated.

Concrete - Only the right point, nothing else.

Correct - Facts and figures must be correct and to the point. Otherwise it would be like misleading the audience.

Coherent - Whatever is being expressed or communicated must be in a proper flow without any gap or jump in the smooth development of the expressions

Complete - All the relevant information, facts and figures must be given effectively without any omission at all. Else, this shall lead to confusion.

Courteous - Messages must be in adequately-refined languages understandable to the people at all levels,



1.8 LET US SUM UP

- While it is difficult to exactly say when the phenomenon of modern science emerged, there are more than one views about it
- One prominent view is that it was initiated in the high middle ages (1277 to be precise) or with 'via moderna' in the 14th century. Another view is that it was the re-birth of science with the Italian Renaissance
- The scientific revolution is supposed to have taken place in the period of Copernicus to Newton

- The earliest trace of Science journalism can be traced back to around 120 years to prominent science fiction writer HG Wells
- Carr Von Anda was a prominent and prolific science journalist with The New York Times since 1904 for many productive years
- The National Association of Science Writers (NASW) was formed in 1934 in the USA
- George W Gray of Time in 1937 opined that science journalism needed to inculcate awareness about making scientific methods an integral part of popular education
- Digdarshan (1818, Hindi, Bengali and English) was the first ever magazine carrying science news in a prominent way in our country
- The first newspaper in Assamese and the present North-Eastern Region of India - Orunodoi (launched in 1846) carried science news also.
- The Hindu dedicates a full page every week for coverage of some specific aspects of science and technology.



1.9 FURTHER READING

1. The British Journal for the History of Science | Cambridge Core
2. Science journalism: Too close for comfort, retrieved from Science journalism: Too close for comfort | Nature
3. Patairiya, M. Science journalism in India, retrieved from file:///C:/Users/admin/Downloads/2182-Article%20Text-8437-1-10-20160714.pdf
4. What Is Science Journalism? Retrieved from https://www.gcu.edu/blog/engineering-technology/what-science-journalism
5. Science journalism through the thicket of science retrieved from https://www.thehindu.com/opinion/op-ed/science-journalism-through-the-thicket-of-science/article66369346.ece
6. Science Journalism Initiative, retrieved from https://erc.europa.eu/apply-grant/science-journalism-initiative
7. Indian Science Communication Society, www.iscos.org



1.10 ANSWERS TO CHECK YOUR PROGRESS

Ans. to Q. No. 1: Science needs to be communicated because it is the basis of life. Also a proper usage of its developments and findings determine the level of standard of living of any society across the world. The research findings in the laboratories have to be applied to human conditions so that we can live a better scientific, logical and rational life.

Ans. to Q. No. 2: Yes, there definitely is a strong connection. If we are knowledgeable about what harm can be afflicted by bacteria and how to prevent it, it shall be helpful to avoid such a situation. Similarly, if we know the proper use of masks we can wear it effectively to prevent diseases which can be spread by air. Thus, science can help us in prevention of many health-related issues and also avoiding superstitious activities.

Ans. to Q. No. 3: It is not very simple to find out the exact period or time when modern science has emerged. There are several established opinions about it with each having its justification. However, rather than focussing more on this aspect, the right attitude should be to look for every feasible means of communicating the important findings of Science & Technology to the right target audience for greater cause and benefit. Also, the struggle and great sacrifices of those pioneers in this field made in the early days of emergence of modern science need to be studied properly.

Ans. to Q. No. 4: Science revolution refers to the age and the happening of coming up of quite a few highly important inventions and discoveries in this field which had revolutionized the world in various fields. For example, Galileo Galilei, Copernicus, Archimedes, Newton and several other scientists who are pioneers in this direction have established many scientific facts and developments which are universally accepted. So, like a revolution, a major body of various

scientific developments took place during this period which is termed as a science revolution.

Ans. to Q. No. 5: Nicolaus Copernicus, a European (Polish) scientist is known as the father of modern astronomy. He had established the fact that the earth and other bodies moved around the sun. Though his theory was not accepted by the society at that point of time, it has changed the way the learned community looked at the solar system later on.

Ans. to Q. No. 6: Science journalism can be said to have emerged around 120 years ago. That was when the already-established science fiction writer HG Wells felt the need for writing some science and technology developments in popular language for peoples' understanding. So, he can also be called as the pioneer in this field.

In the Indian context, Digdarshan published in 1818 is said to be first ever journal / newspaper which published news of science in its issues. It is interesting to note that this magazine was published in Hindi, English and Bengali. It may be noted that the first ever Assamese newspaper Orunodoi also published some amount of science news in its issues.

Ans. to Q. No. 7: He was a prominent science communicator of Time in 1937. He famously declared that science journalism needed to inculcate awareness about making scientific methods an integral part of popular education and through it a universal element of civilized thinking". This has gone a long way since then to advance as well as forward the direction of science journalism to new heights at present.

Ans. to Q. No. 8: Yes. Many newspaper and magazines of the country and the world regularly publish science news in their issues. This is done at two levels. First, many of them like The Hindu and The Frontline have dedicated pages for science and technology-related news items always. The magazine carries in each of its issues while The Hindu have one page in a week for this purpose. Secondly, newspapers and magazines also publish science news on different

aspects as and when they emerge depending upon the importance and relevance of the issue.

Ans. to Q. No. 9: The Indian Science Communication Society (ISCOS) based at Lucknow has been providing training in science journalism to interested people for so many years now. This is in addition to many other science communication activities they undertake from time-to-time. These include publication of a quarterly journal named Indian Journal of Science Communication which is in its second decade of existence.



1.11 MODEL QUESTIONS

A. Short Questions (Answer each question in about 150 words)

Q. 1: Briefly discuss science journalism in India and the world.

Q. 2: What are the aspects which needs to be observed while practicing science journalism ?

Q. 3: Identify a few areas which, according to your opinion needs more focus in the media of the state or the country. How would you write a news/ feature on one or two of such issues ?

B. Long Questions (Answer each question in about 300-500 words)

Q. 1: Discuss the emergence of modern science in this world.

Q. 2: Explain your understanding of the term - Science Revolution.

Q. 3: What is the importance of science communication / journalism in today's era ?

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UNIT 2: BEGINNING OF SCIENCE COMMUNICATION IN INDIA

UNIT STRUCTURE

2.1 Learning Objectives

2.2 Introduction

2.3 Beginning of science communication in India

- 2.3.1 Contribution of Print Media
- 2.3.2 Contribution of Radio
- 2.3.3 Contribution of Television

2.4 The science communication movement in India

2.5 History of Science Journalism in India

2.6 Let Us Sum Up

2.7 Further Reading

2.8 Answers to Check Your Progress

2.9 Model Questions

2.1 LEARNING OBJECTIVES

After going through this unit, you will be able to

- explain how science communication began in India
- discuss the contribution of different medias in science communication
- explain the significance of science communication movement in India
- analyse the history of Science Journalism in India

2.2 INTRODUCTION

In the first unit of this course we have concentrated on the concept of Science Communication, its need and significance. This unit is going to cover some important topics as the beginning of science communication in India and the contribution of print and electronic media in carrying science to the masses. Besides, science communication movement in India has been given particular emphasis since efforts to popularise science among

the masses have been undertaken at the level of the Government and non-governmental sector.

In this unit, the history of science communication in India will be summarized. The contribution of different medias like print, radio and television will also be further discussed in the unit.

2.3 BEGINNING OF SCIENCE COMMUNICATION IN INDIA

There have been many instances in the history of science when scientists gave particular attention to communicating their thoughts to the public. During the eighteenth century, for example, the phase now known as the Enlightenment produced a good number of scientific books, many of which sold very extensively. Science even became fashionable and public lecturers attracted audiences that included a large section of the society from society ladies to the working men.

But the lack of public understanding of science today inspite of the omnipresence of science in every sphere of life is a matter to be discussed about. The “Public understanding of science” movement can be traced to the report of the Royal Society in England which drew the following conclusion-

- Science and technology play a major role in most aspects of our daily lives. Our national prosperity depends on them.
- There is scope for more science in the media and strong case for more science in general programmes and for improving the contact between scientists and journalists.
- Scientists must learn to communicate with the public.

The Royal Society seemed to be guided by the belief that more the people knew about science and technology, the more they would come to value and respect science.

India has an imposing scientific heritage. Scientific research in fields such as mathematics, astronomy, medicine and material science has been carried out in the Indian sub-continent since ancient times. However, a

remarkable gap has persisted between this scientific knowledge and the 'common' man and woman and, until recently, almost no effort has been made to bridge this gap. Scientist and a class of people of different countries have been trying to popularize science among the masses over the periods. In India popularization of science was visible very strongly after the British came. Scientists like Meghnad Saha, Satyendra Nath Bose, C.V. Raman, and D.S. Kothari, Mahendralal Sarkar, Jagadish Chandra Bose, Prafulla Chandra Ray, Ruchi Ram Sahni and others carried science to the common people and had done a lot in this context. This trend had been continued after independence also.

It was Pandit Jawaharlal Nehru, the first Prime Minister, who first introduced the concept of 'scientific temperament' and emphasized on its promotion in the society. In 1958, a proposal was taken in the Cabinet in this regard and to solve the problems of the country by using science for the upliftment of the people. In fact, in our constitution, Article 51 (A) says that it is the duty of all citizens "to develop scientific temper, humanism and the sprit of enquiry and reform."

Now, let us discuss the contribution of print and electronic media in popularizing science in the last few decades.

2.3.1 Contribution of Print Media

Vijnan Sanchar (Science Communication) a book by Dr. Manoj Kr Patairiya carries a historical account of science journalism and science communication in India. Some significant highlights are present here. Throughout history, there have been attempts to take science to the common people. For example, *Vigyan* (Science) — a monthly popular science magazine in Hindi — has been published by Vigyan Parishad (a learned society of scientists and academics) since 1915. News, views and features on scientific topics have been appearing , though sporadically, in Indian media since second half of the 19th century. Popular science writing started in the year 1818 through bilingual (Hindi- English) '*Digdarshan*', published from Srirampur, West Bengal. In 1842, a Bengali magazine *'Vidyadarshan'*

carried a series of science articles. In subsequent years magazines and newspapers like Marathi *'Dhyan Parcharak',* Tamil *'Chitamani'*, Assamese *'Arunudoi'* etc were the pioneers in publishing science features and news from time to time. Meghnad Saha a famous scientist used to write regularly on various scientific issues in the research journal "Science and Culture". Science writing in English started in India with the publication of *'Science Reporter*' in 1964 by CSIR. Prior to that *'Vigyan Bidhi'* in Hindi was launched in 1952. In 1966, Times of India started publishing *'Science Today'*. In 1971, NRDC also launched *'AVISKAR'* in Hindi. Another science magazine named 'Science Age' was published in 1983 by Nehru Center, Mumbai. *'Down to Earth'-* a magazine devoted to environmental issues was started in 1991 with the effort of Centre for Science and Environment. However, both *'Science Age'* and*' Science Today'* do not exist any more. But *'Science Reporter', 'Vigyan Pragati', 'Invention Intelligence'*, and *'Aviskar'* are still continuing. Some computer magazines like 'Computer Today' and 'Data Quest' have become popular. Meanwhile, science features, news, reports etc. are regularly appearing in major English Newspapers through supplements or in Sunday issues. The Regional newspapers have also started emphasizing science coverage in order to promote scientific temperament among the people.

2.3.2 Contribution of Radio

Radio Broadcasting was started in India in 1927, with two privately owned transmitters in Bombay and Calcutta. The government took over the transmitters in 1930 and stared operating them under the name of Indian Broadcasting Service. It was changed to All India Radio (AIR) in 1936 and later it came to be called as 'Akashvani' from 1957. AIR is working as an effective medium to inform and educate the people besides providing healthy entertainment.

All India Radio (AIR) has been playing an important role in popularizing science among the Indian masses. Science programmes are being broadcast by AIR for a long time since its establishment in 1936. In an effort to give science communication a new dimension, Science Cells was established in some radio stations in 1975 with science trained executives. Some science officers like Dr. R Sreedhar, Dr. Krishnamurthy, Amit Chakravarty, Usha Bhasin, Aparna Vaish, Brij Mohan Gupta, Nilima Harjal, Jayanta Erande, Dr. Kishore Kulkarni, Dilip Mayangbam etc have made valuable contribution in science broadcasting. Some radio serials like *Manav ka Vikash* (1991-93), *Vigyan Vidhi* (1987-88) etc proved extremely useful in popularizing science with a sizeable portion of the audience remaining glued to the radio at the time of the broadcasting of these serials which were so popular that later they were broadcast in many regional languages. The regional language stations took very successful steps in promotion of science. Among them, the phone-in programmes and radio-bridge programmes are very popular.

The, Radio Farm Forum was constituted in seven radio centers of the country. In the year 1966, keeping in view the importance of agriculture in our country, in some radio stations Agricultural Unit was opened and some Farm and Home Units were also started at various stations. Besides, the Broadcast also included programmes for rural women and rural children where the main thrust is on issues relating to the rights of the child, gender bias and child abuse. Science also got specific space in Akashvani. From 25th June 1989 to 24th September Akashvani in collaboration with National Council of Science and Technology Communication aired a series of programme named *'Bigyan Bidhi'*, comprising 13 episodes. Under this programme, through different regional Indian languages 1,40,000 children of age group between 10 to 14 in the country were registered as radio listeners. Another serial named *'Human Evolution'* was broadcast from all the stations of AIR, in respective regional languages. Central Production of AIR, New Delhi in collaboration with National Council of Science

and Technology Communication (NCSTC), produced that programme. Another programme called 'Paryavaran', jointly produced by AIR and Vigyan Prasar, was broadcast from January 1998 to December 1998. In the same year, another serial named 'Chhoo–Mantar' was broadcast on AIR, Delhi from 3rd October. AIR and 'Vigyan Prasar' jointly produced this 52 episode serial. Other than AIR, various Private FM radio and Community radio stations also broadcast science related programmes. The Ministry of Information and Broadcasting has given emphasis to airing science programmes, so that different aspects of science can easily reach the masses.

2.3.3 Contribution of Television

The use of broadcast and digital media has opened a new vista of science communication in India. Doordarshan, the national television service of India devoted to public service broadcasting is one of the largest television networks in the world. Since its inception in 1957, Doordarshan has been telecasting science programmes for students. The first popular science programme telecast by it was *'Vigyan Partrik'* during 1971 to 1975. In the year 1966, agriculture based programmes began to be telecast. The year 1982, when colour television came to India brought a new phase in television service in India. During 1984-92, a popular science programme named *'Quest'* produced by Calcutta, *Doordarshan,* ran for eight years. A programme on the growth of science in India was produced by NCSTC and it was called *' Bharat Ki Chap'*, *'Bigyan ki Baate'.* It had been broadcast every Saturday. Then *'Turning Point'* was another landmark programme that started in 1991 which had been telecast in some regional languages also. Doordarshan also telecasts some western Television programmes. Many private TV channels such as National Geographic, Animal Planet , Discovery etc have been producing science programmes on a number of issues and after the emergence of these private channels , science and technology have become much more interesting for everybody.

In both Print and Electronic media scientific awareness is being promoted through advertisement. A good number of government departments, both Central and State, have been using commercial broadcasting to disseminate important information on science to the people. In this regard, we can mention the efforts of creating awareness about bird flu, AIDS, family planning, pulse polio, immunization, energy conservation, pollution, environmental problem and other important issues.

Besides the print and electronic media, Folk media also play an important role in this context. Through street plays, puppet shows, theatre, folk songs, folk dance etc. folk media have contributed a lot in popularizing science, especially among the rural masses. In fact, at present, internet also plays a vital role in providing various upto-date scientific information.



CHECK YOUR PROGRESS

Q.1: Doordarshan started its services in the year.....

Q.2: ..... a Popular science writing started in the year 1818.

Q.3: All India Radio (AIR) came to be known as .....

2.4 THE SCIENCE COMMUNICATION MOVEMENT IN INDIA

For the past two decades, science communication activities have gained momentum in India. Efforts have been made from both governmental and non-governmental platforms to enhance the public understanding of science. The idea is to help science and a scientific culture penetrate India's socio-culturally diverse society, and to transform it into a nation of scientifically thinking and scientifically aware people. After Independence, a number of government agencies and non-governmental organisations (NGOs) took their cue from the constitution and became involved in science popularisation. In this way, science

communication was taken up at various levels, institutional as well as individual. Nehru was a major force behind this advancement of science in independent India.

The National Institute of Science Communication and Information Resources (NISCAIR) — previously the Publications and Information Directorate (PID) and subsequently NISCAIR began the publishing of the Hindi popular science journal *Vigyan Pragati* (Progress in Science) in 1952. The Science Reporter (an English monthly) and *Science Ki Dunia* (an Urdu quarterly) followed soon after. Today, NISCAIR also brings out 11 professional scientific journals and publishes various popular science books (often in Indian languages).

In 1980, science communication was given prominence in India's sixth Five Year Plan, and two years later the National Council for Science and Technology Communication (NCSTC) was established. The Council has a mandate to integrate, coordinate, catalyse and support science communication and popularisation, at the micro as well as macro level. NCSTC's programmes include training in science and technology communication, software development, research, field-based projects, and creating information networks and databases.

Other Indian government initiatives include Vigyan Prasar, an autonomous organisation of the Department of Science and Technology set up in 1989, which plays an important role in coordinating the efforts among various scientific institutions, educational and academic bodies, laboratories, museums, industry and other organisations for the effective exchange and dissemination of scientific information. Vigyan Prasar also develops and disseminates software materials and organises popular science events including workshops, debates and lectures.

The National Council of Science Museums, based in Calcutta, is the coordinating body of 26 science museums and science centres across the country. Science City in Calcutta has more than 1,000 exhibits and attracts around 500,000 visitors a year. Based on the experiences and popularity of Science City, other such projects are being developed across the country.

Several NGOs have also pursued science communication programmes. The Indian Science Writers' Association (ISWA), for example, was founded in 1985 with a view to developing and nurturing the science writing profession in India. The association has around 200 members and undertakes a broad spectrum of activities including training courses, lectures and fellowships. ISWA also works with government agencies and NGOs in promoting science communication activities.

2.5 HISTORY OF SCIENCE JOURNALISM IN INDIA

Whenever we talk about science, the first thing that comes to our mind is formulae, experiments relating to different fields like physics , chemistry and biology. We used to dread these subjects thinking about trying to memorise all the theories and calculations and passing the ultimate litmus test- the exams. No matter how much we dread those areas of science, it still managed to have a profound grip on us for its ability to focus and look at certain things from a scientific point of view. In India, the government has undertaken various science popularization techniques or schemes for the development of scientific temperament in the minds of the people. Development of science journalism is one such area whereby people are kept abreast of the science based news by way of reports and features.

Science journalism is a branch of journalism that uses the art of reporting to convey information about science topics to a public forum.

Subsequently there were Publications in Hindi like 'Saral Vigyan Vitap' (1860), Sulabh Beej Ganit" (1875) and 'Gati Vigyan' (1885) . In 1842, a Bengali magazine 'Vidyadashan' carried a series of science articles. In subsequent years, magazines and newspapers like Marathi 'Dhyan Parchanak', Tamil'Chitamani', Assamese 'Arunodoi' etc. were some of the pioneers in the publication of science features and articles. Efforts were also made to translate notable works of English scientific publications into Hindi language during that period. *Vigyan* (Science) — a monthly popular science magazine in Hindi — has been published by Vigyan Parishad (a learned society of scientists and academic) since 1915.

Towards the turn of the nineteenth century, science communication was mainly limited to publication of books and scientific journals. In the beginning of the twentieth century, new trends emerged. Science congresses, scientific and industrial exhibitions, seminars, industrial and technological museums, public lectures, popular science magazines, etc. were few among the newer developments towards the popularization of science communication.

After Independence, a number of government agencies and non-governmental organisations (NGOs) took their cue from the constitution and became involved in science popularisation. In this way, science communication was taken up at various levels, institutional as well as individual. The Scientific Policy Resolution of March 4, 1958 can be said to be a guiding factor for development of science and technology in the country. India's first Prime Minister, Jawaharlal Nehru was a major force behind this advancement of science in independent India. He initiated reforms to promote higher education in the field of science and technology. In order to imbibe scientific temperament in the minds of the individuals and also to promote technical education in the country, the first ever Indian Institute of Technology (IIT) was established in August 1951 at Kharagpur in West Bengal. Some of the eminent scientists of that time also contributed in the form of writings in various research journals. One of them was Meghnad Saha, a famous scientist who used to write regularly on various scientific issues in the research journal 'Science and Culture'.



Vigyan Prasar: It is an autonomous organisation of the Dept. of Science & Technology which was set up in 1989. it plays an important role in coordinating efforts among various scientific institutions, educational and academic bodies, laboratories, museums, industry and other organisations for the effective exchange and dissemination of scientific information

The National Institute of Science communication (NISCOM), previously known as the Publication and Information Directorate also began publishing the monthly Hindi magazine ***Vigyan Pragat*** in 1952. It was a newsletter disseminating information on scientific research activities before being converted into a popular science magazine in order to inculcate a scientific temper in the minds of the common masses. This was followed by *The Science Reporter* (an English monthly) and *Science Ki Dunia* (an Urdu quarterly). In 1966, Times of India started publishing 'Science Today' and in 1971, NRDC also launched 'AVISKAR' in Hindi. Another science

magazine by the name of 'Science Age' was published in 1983 by Nehru Centre, Mumbai. One of the most popular magazines of that time , 'Down to Earth' was started in 1991 which was completely devoted to environmental based news.

Apart from the above mentioned science related journals and magazines, there are also other SCI (Science Citation Index) publications which are totally devoted to the field of pure sciences. These are described as the world's leading journals of science and technology, because the papers are selected after a rigorous selection process. As per the 'Evidence for Changing Trends' report of the Department of Science and Technology, Government of India, July 2012 , the relative performance of various sub sectors and disciplines of science with respect to SCI publications has been studied for 21 disciplines (for example- Clinical medicine, Microbiology, Social Sciences, Plant and Animal Sciences, Agricultural Sciences, Environment and Ecology etc.) . The study has revealed that the total number of publications from India has increased from 106,456 during 2001-05 to 177,208 in 2006-10. This amounts to an increase of about 66% during the five year period.



LET US KNOW

The **Science Citation Index (SCI)** is a citation index originally produced by the Institute for Scientific Information (ISI) and created by Eugene Garfield. It was officially launched in 1964 and is now owned by Thomson Reuters. The larger version of it (Science Citation Index Expanded) covers more than 6,500 notable and significant journals, across 150 disciplines, from 1900 to the present. These are alternately described as the world's leading journals of science and technology, because of a rigorous selection process.

As an effect of the sudden accessibility of scientific knowledge to all social classes, small local groups of science writers and people who were involved in activities pertaining to the diffusion of scientific culture and

knowledge began to form. Kerala Sastra Sahitya Parishad (KSSP) was the first such group to be established which over the years went on to become one of the largest and most active associations in this particular area. The People's Science Movement (later changing its name to All India People's Science Network) was founded in the 1980s . It consisted mainly of a committee for the coordination of the numerous local and regional non-governmental organisations. The Kerala Sastra Sahitya Parishad wanted to bring the common masses into its fold by way of *Science Jahtas* (Mazzonetto, 2005). The Jahtas are basically small groups of artists, scientists, teachers, students and unemployed youths, travelling from one village to another village in a kind of procession. They stage shows at every stop which are generally accompanied by songs and puppet shows and well supplemented by the distribution of explanatory leaflets. The People's Science Movement spearheaded a massive movement on 2nd October, 1987 . The movement consisted of five different processions comprising thousands of volunteers and covering 5000 kilometres in 37 days. The shows lasted for several hours in the village of some of the major Indian districts and culminated in the city of Bhopal on the occasion of the anniversary of the Bhopal Gas Tragedy. It was estimated that about one third of India's population attended various shows based on environment based themes like climatic catastrophes, biodiversity etc.

As far as the electronic media is concerned, radio and television have also played a crucial role in the popularization of science communication. In an effort to give science communication a new dimension , Science Cells were established in some radio stations in 1975 by executives who were given scientific training. Some radio serials like Manav ka Vikash (1991-93) and Vigyan Vidhi (1987-88) proved extremely useful in popularizing science. Since its inception in 1957, Doordarshan has been telecasting science programmes for students. Some of the popular science based programmes telecast by Doordarshan are Vigyan Partrik (1971-75), Quest (1984-92), Turning Point, Bharat Ki Chap, Vigyan ki Baatein etc. Apart from these programmes, channels like National Geographic, Discovery

Channel, Discovery Science and Discovery Turbo also show cases certain programmes that are related to the area of science and technology. For example, some of the popular programmes of National Geographic are Cosmos : A spacetime Odyssey, Live from Space, Mad Scientists , Known Universe, etc.

With a view to integrate, coordinate, catalyse and support the cause of science communication, various organisations and associations like National Council for Science and Technology Communication ***(NCSTC)***, National Centre for Science Communicators (NCSC), Vigyan Prasar, Indian Science Writer's Association ***(ISWA)*** have been instituted.

Now let us discuss some of the dimensions of the state of science journalism in India which have been highlighted by Dr. Manoj Kumar Patairiya, Director , National Council for Science and Technology Communication (NCSTC), New Delhi.



NCSTC: NCSTC was established in 1982 and is a Division in the Dept. of Science & Technology , Government of India. The Council has a mandate to integrate, co-ordinate, catalyse and support science communication and popularisation at the micro as well as macro level.



ISWA: ISWA was founded in 1985 with a view to developing and nurturing the science writing profession in India

I. Science Journalism and the role of Mass Media

Science journalism is a special branch of journalism which mainly conveys reporting about science to the public. The field typically involves interactions between scientists, journalists and the public. Media's role is particularly important for the dissemination of scientific knowledge and information. Different forms of media like print media, electronic media, new media, folk media, interactive media and digital media have been playing a sterling role in the popularization of science communication. Among the different forms of media, electronic media has a profound effect because it is an audio-visual medium. Moreover, dissemination of scientific information requires the demonstration of moving images, models , charts etc. which will not be very much effective if it is propagated through print medium.

Folk media is another form of media which has a wider reach and appeal. Puppet shows , street plays, stage performances, folk songs and dances are some of the examples of traditional means of communication. People find it easy to relate to such forms of media because of the fact that the medium of instruction is usually the local languages. It is also cost-effective, entertaining and offers two-way form of communication.

Science exhibitions, science fairs, seminars and workshops are some forms of interactive media which provides a platform for the science communicators/instructors to disseminate knowledge related to scientific thoughts and processes. It also enables them to demonstrate the different areas of science based subjects with the help of models, audio-visual aids etc. Digital media in the form of internet, CD-ROM, multimedia etc. have also lend a helping hand in delineating the various issues related to the field of science and technology. Various forms of presentation are used for making science communication more interesting and enjoyable such as news report, article, story, interview, discussion, documentary, docu-drama etc.

Thus, the use of broadcast and digital media has opened up new vistas of science communication. Development of the IT sector has made it possible to get access to different forms of scientific information at the click of a mouse.

II. Trends in Science Writing / Reporting

As far as the print media is concerned, a lot depends on the way information is presented in the form of news reports, articles and features. This is because, unlike electronic media, reports have to be written in a clear and simple language devoid of any specific technical jargon. Science writing is a skill that every science communicator or journalist is required to develop and hone it with experience. It is often seen that most of the articles in Indian languages are translated from the original English ones. While doing so , the authors may not be able to bring out the complete meaning of the original work. So, it is necessary to encourage the writers for original science writing in Indian languages.

Now the question that arises is how should one write a science article? Usually readers prefer those articles that are informative, analytical , critical and having a continuous flow. In order to write an article on any particular issue or topic related to science , one needs to undergo extensive literature review and discuss the relevant topic with experts. This is because scientific knowledge is based on facts and figures and if that is not found to be authentic, then it might create confusion in the minds of the readers. It is pertinent to bear in mind that an integrated and balanced view of the topic/issue needs to be presented in a language easily intelligible to the common public.

It has been seen that a writer uses the popular article of another writer as a source for his writing and subsequently a third writer uses his/ her article leading to a chain of substandard articles. This may ultimately lead to formation of distorted news which must be avoided. As far as the coverage of news is concerned, it has not been able to achieve the desired mark. This is because, barring a few channels and newspapers, the coverage of science based news and issues is quite poor. Rarely do we come across a science reporter or an editor who is associated with any media organisation. So, it is desirable to have science correspondents with most of the media houses. This would, in due course, help evolve a policy on editing and reporting of contemporary topics on science and technology in different modes of presentation in the media.

III. Reporting on local issues of scientific importance

While reporting on different scientific issues it is necessary to bring under its fold local and regional issues. Only then the reader or the viewer will be able to get a complete picture of the prevailing problems and be able to look at it from a different angle. This is because very often , most of the major dailies and the media houses give ample amount of coverage on the world issues thereby ignoring those which would otherwise have widened the knowledge base of the general public.

IV. Investigative science journalism

There is a need for investigative journalism in the field of science communication. Contributors of scientific writings are basically from the public sector and as such it is difficult to expect them to be analytical or self-critical. Moreover most of the research and development activities in the country are carried out within the confines of government laboratories and there is hardly any means for the common people to know what scientists are doing. In order to generate awareness in the field of research amongst the people, there is a need for investigative journalism in this field. In fact, transparency in reporting the various activities pertaining to research and development must be maintained keeping in mind the greater interest of the society. People must be made aware of the good effects as well as the harmful effects of science on the society.

Thus, the basic purpose of scientific writing is not the mere presentation of information and thought, but rather its actual communication. It does not matter how pleased an author might be to convert all the right data into sentences and paragraphs; it matters only whether a large majority of the reading audience accurately perceive what the author had in mind.

V. Science Journalism and Scientific Literacy

Science journalism is an important branch of journalism as it helps people to keep abreast of the latest developments that take place in the field of science and technology. A person must also have the scientific bent of mind in order to comprehend as to what is being written or broadcast. This is what is known as scientific literacy. It is the knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs and economic productivity. Scientific literacy is necessary for the overall well being of the people and for the exercise of participatory democracy. The last two decades have witnessed a rapid expansion in the field of science and technology with newer gadgets being invented every year. In the field of healthcare too, better amenities have been developed which have drastically reduced the mortality rate of human beings. People , especially those living in the far flung areas are not aware of such newer developments which in turn have a negative impact on their overall well being. Herein comes the role of science journalism which can go a long way in enhancing public awareness about the different facets of scientific knowledge and communication.

VI. Creating the Creators

In order to create awareness about the latest developments in the field of science and technology , trained science communicators are necessary who in turn will be able to properly disseminate scientific knowledge and communication. It is necessary to develop trained manpower in the area of science journalism, writing, communication and training. These days most of the educational institutions and other government organisation offer short term courses (3-7 days duration), medium term courses (2- 4 months duration)and long term courses (1-2 years duration) in the field of science communication.

Apart from the above mentioned courses, training programmes and workshops are organised for the regional writers, journalists and illustrators. The main idea behind organising such courses is to develop grass root science writers and journalists who can serve as contributors in the field of scientific writing with the help of locally available resources.

Challenges in the field of science journalism :

Science journalism is an upcoming and special branch of journalism. It holds the key to the real treasure of the scientific knowledge, by virtue of which scientific knowledge and concepts can be carried to the common man. In spite of a number of efforts for developing science journalism in India, there are certain challenges which must be met in order to fully develop it as a specialised area of journalism.

a. Growth trajectory of science communication is limited

India's science promotion activities are mostly concentrated at the institutional levels while some need-based programmes are organised randomly. Even though there has been a phenomenal growth in the field of mass communication and journalism, yet the growth trajectory of India's science communication is very much limited and do not look very promising. As has been seen , science writing is concentrated among the scientific community and academic institutions. Moreover, the number of qualified science journalists and writers is alarmingly low and hardly sufficient to cater to the large target audience.

b. Media coverage on issues related to science and technology is poor

Another factor which might impede the development of science journalism in India is the poor coverage of science based news and information. Except for a few papers and magazines, mainstream media coverage on issues related to the field of science and technology is quite low and limited. Most of the front page news are usually dedicated to non-scientific issues like politics, economics, entertainment based news , issues related to the society etc.

Whereas some serious issues pertaining to India's economy, poverty, health, medicine, agriculture, environment or science and

technology are either ignored or given a little media space and time. One of the reasons why issues related to science and technology is ignored is basically due to the fact that science writing is relatively a new area and it requires proper training and skill in the preparation of such reports.

c. Science journalism as a profession is still in the nascent stage

Unlike other countries, science journalism is yet to materialise as a lucrative career opportunity in India. Only a few institutes have sprung up in the country to offer basic training on science communication and journalism. This is because in order to be recognised as a qualified science communicator, one needs to have proper skill and knowledge in the field of science and technology. A 'science communicator' encompasses a range of profession such as scientists, public relations practitioners, journalists, science centre workers, education officer etc. The type of science they communicate can be specialized or diversified, across any scientific fields such as physics, forestry, robotics, biology, astronomy or geography.

d. Conflict between scientists and journalist over the issue of transparency

Of late we have seen a rise in the conflict between scientists and journalists which can act as a big stumbling block towards the progress of science journalism in India. This can however be resolved by way of organising scientists-journalists meet on regular basis. Popular science writing in India is still shackled by complacency and over-dependence on foreign sources. The issue which can be attributed to the growing conflict between the scientists and the journalists is that of transparency in the way news is transmitted to the society. Sometimes, it is quite difficult to elicit authentic information from a scientific laboratory. This can lead to misleading scientific information, distortion in translation, lapses in the use of languages and so on. Moreover, the scientists in some organisations are not allowed to leak out specific information to the media. Thus, it is

necessary to have a science media centre, including a centralised website in order to facilitate easy accessibility to scientific information by the media persons.

e. Scientific language has never been the language of the masses

One of the debatable issues in the academic circle is that of the use of scientific language which has never been the language of the masses. By 'language of the masses' we mean to state that it is not the common language of interpretation and communication among the masses. Rather, scientific language is utilised only while engaging in public debates, preparing for examination purposes and also while writing on topics related to science and technology. This can be the reason as to why it is difficult for the public to ascribe value to the importance of scientific knowledge. Large sections of the population are not even aware of the latest technological advancements in the field of science and technology even though they make use of the technologies in their day to day activities.

Thus, after examining all the above mentioned factors, we can say that a multi-prolonged strategy is necessary to make science communication more effective and interesting. The need of the hour is to popularize science communication among the masses through different mass media. As far as the electronic media is concerned, soap operas occupy most of the prime time slot in the India television. So, efforts must be made to develop more science based programmes keeping in mind the needs and preferences of the people. In India, organisations like National Council for Science and Technology Communication, National Centre for Science Communicators and Vigyan Prasar can be lauded for their efforts in popularizing science communication right to the grass root level. In order to generate interest in the minds of the masses, there must be creativity in the field of science writing and journalism. The text must be written in such a way so that the people can comprehend its meaning without having to resort to other reference materials. More importantly, planned agenda and policies for science communication in a truly transparent manner are a pre-requisite to engage and speed up science communication.



CHECK YOUR PROGRESS

Q.4: When was the science magazine 'Science Age' first published?

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.....

Q.5: Can folk media be used as an important media for science communication?

.....

.....

.....

Q.6: Is it necessary to focus on only national issues while reporting for science communication?

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.....

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Q.7: What is science journalism?

.....

.....

.....

Q.8: When was SCI launched?

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.....



2.6 LET US SUM UP

- Pandit Jawaharlal Neheru, for the very first time introduced the concept of 'scientific temperament' and emphasized on its promotion in the society.
- Vijnan Sanchar (Science Communication) a book by Dr. Manoj Kr Patairiya carries a historical account of science journalism and science communication in India.

- Down to Earth'- a magazine devoted to environmental issues was started in 1991 with the effort of Centre for Science and Environment.
- Radio Broadcasting was started in India in 1927, with two privately owned transmitters in Bombay and Calcutta.
- The National Council of Science Museums, based in Calcutta, is the coordinating body of 26 science museums and science centres across the country.
- Science journalism is a branch of journalism that uses the art of reporting to convey information about science topics to a public forum.
- A science journalist (or science writer) is a journalist who specializes in writing about science topics, and thus practices science journalism, or popular science.
- The People's Science Movement (later changing its name to All India People's Science Network) was founded in the 1980s
- ISWA was founded in 1985 with a view to developing and nurturing the science writing profession in India



2.7 FURTHER READING

1. Bucchi, Massimiano & Brian Trench (2008), *Handbook of Public Communication of Science and Technology*, Routledge.
2. Narlikar, Jayant V.,(2003), *The scientific Edge*, Penguin Books



2.8 ANSWERS TO CHECK YOUR PROGRESS

Ans. to Q. No. 1: 1957

Ans. to Q. No. 2: Digdarshan

Ans. to Q. No. 3: Akashbani

Ans. to Q. No. 4: 1983

Ans. to Q. No. 5: Folk media can definitely be used as an important media for popularization of science communication because it has a wider

reach and appeal. Puppet shows , street plays, stage performances, folk songs and dances are some of the examples of traditional means of communication. People find it easy to relate to such forms of media because of the fact that the medium of instruction is usually the local languages. It is also cost-effective, entertaining and offers two-way form of communication.

Ans. to Q. No. 6: One must focus both on national and local issues while reporting for science communication. Only then the reader or the viewer will be able to get a complete picture of the prevailing problems and be able to look at it from a different angle.

Ans. to Q. No. 7: Science journalism is a branch of journalism that uses the art of reporting to convey information about science topics to a public forum.

Ans. to Q. No. 8: 1964



2.9 MODEL QUESTIONS

A. Short Questions (Answer each question in about 150 words)

Q. 1: Write a note on the beginning of science communication in India.

Q. 2: Describe how different science based organisation have contributed towards the science communication movement in India?

B. Long questions (Answer each question in about 300-500 words)

Q. 1: Do you think the print media needs to cover more science based issues in order to generate awareness among the masses?

Q. 2: Explain how media contributed towards the onset of science communication in India.

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UNIT 3: SCIENCE COMMUNICATION IN ASSAM

UNIT STRUCTURE

3.1 Learning Objectives

3.2 Introduction

3.3 Science Communication in Assam

- 3.3.1 Pre Orunodoi era
- 3.3.2 Orunodoi era
- 3.3.4 Post Orunodoi era
- 3.3.5 Post Independence era

3.4 Science Magazines in Assam

3.5 Let Us Sum Up

3.6 Further Reading

3.7 Answers to Check Your Progress

3.8 Model Questions

3.1 LEARNING OBJECTIVES

After going through this unit, you will be able to

- explain how Science Communication began in Assam
- discuss the progress of science communication in different aspects in Assam.

3.2 INTRODUCTION

In the previous units of this course we have learnt about the concept of Science Communication and its various aspects.

In this unit we will discuss the beginning of science communication in Assam. Science Communication was not an alien concept in Assam where it has passed through various stages of growth from the pre Orunodoi era to the present time. Right from the translation of a popular book on Mathematics in 1434 by Bakul Kayastha ,Science Communication has come a long way to claim for itself a respectable place as a medium for popularizing of science. This unit will chart the steady growth with particular attention to the popularity of science magazines being written at different points of time.

3.3 SCIENCE COMMUNICATION IN ASSAM

There has been special relationship between scientific world and the mass media in Assam ever since the first Assamese newspaper Orunodoi which began to be published from 1846. Science Communication in Assam has been evoled over a few phases such as Pre Orunodoi, Orunodoi, Post Orunodoi and post independence. In each of these phases mass media has been used for the purpose of making people aware of scientific achievements and scientific attitude. Given below is a historical overview of the growth of Science Communication in Assam.

3.3.1 Pre Orunodoi era

Assamese science literature in written form was started in the fifteenth century as sponsored by King Naranarayan during the Vaishnavite movement. Bakul Kayastha translated a popular book on Mathematics namely Kitab Manjuri in 1434. Bakul Kayastha therefore can be regarded as the first Assamese science writer and Kitab Manjuri as the first Assamese science book. Even before that, Assam had a long and magnificent tradition of popularization of science beginning with Dr. Dinesh Ch. Goswami says : “The Assamese society paid a lot of importance to scientific temper and scientific practices in day to day life. The sayings of Daka Purusha during the 4th or the 6th century, very well depict the practice of science and its acceptance by and influence on the society. Daka’s sayings cover almost all aspects of the day to day rural life including agriculture, health, hygiene, gynaecology, pediatrics, infant care and food and nutrition.” This comment by one of Assam’s pre-eminent science communicator neatly sums up the science communication scenario in Assam in the earliest phase.

3.3.2 Orunodoi era

As Dr. Manoj Patairiya, renowned science communicator, cited in his article *Science Journalism in India,* it was all started in the

country in 1818 with the publication of the monthly *Digdarshan,* which was published in Hindi, Bengali and English, carrying a few articles on science and technology. Assamese Science journalism can be traced back to the mid nineteenth century, i.e., just after 28 years of the publication of *Digdarshan,* the first Indian journal to carry science and technology information. Assamese science journalism started with O*runodoi*, the first Assamese newspaper published from January 1846.

The most interesting fact is that this first Assamese newspaper *Orunodoi* represents the Baptists' Church's role benefactor towards the people of Assam particularly in the field of education with the publication. The publishers wrote in the printers line of the Orunodoi the following words : "The Orunodoi - A monthly Paper, devoted to Religion, Science and General Intelligence, is printed and published at the Sibsagor Mission Press, by O. T. Cutter, for the American Baptist Mission in Assam." Later, Pandit Maheswar Neog stated that 'the Orunodoi was devoted to Science and General Intelligence" is especially to be emphasized, as its pages went a long way to extend the intellectual horizon of the readers. The columns brought news stories from all corners of the globe. It explained global geography and gave descriptions of the night sky with its stars and planets.'

The first issue of *Orunodoi* (published in January, 1846) did not carry any science news. But in the February issue, i.e. the second issue, it carried two features with about 35% total space covered in aggregate. The first two essays published in the paper were "*Grahar Bibaran*" and "*Prithibir Akarar Bishai"*. These were a description of the planets and about the size of the planet Earth with two illustrations. In the third issue, the paper published a lengthy feature on the discovery of printing press. In the fourth issue, it carried a detailed write up on the description of the world with two drawings of the globe from west and east sides. In the issue they published an article on the description of the lion with a sketch followed by other animals in the subsequent issues. Regarding the writing style of the scientific

events and news in the *Orunodoi* Pandit Neog opined, 'they could have the intelligence of scientific inventions and discoveries in a simple and digestible form.'

The science books published towards the end of nineteenth century are Nathan Brown's "Bhogol Siksha" (1849) Nidhi Liwai Pharowel's "Padartha Bidyasar" (1855) "Bigyanar Barematara", "Lara Siksha" and others. These may be considered a valuable contribution to science literature in Assamese.

3.3.3 Post Orunodoi era

The post Orunodoi era covers the period from early twentieth century to independence. This period can rightly boast of the publication of a number of science articles published in different Assamese journals. In the beginning of the twentieth century magazines like "*Assam Bandhu*" (1906), "*Alochani*"(1908), "*Jonaki*", "*Assam Bandhav*" (1909), "*Bahin*" (1909), "*Milan*" (1922), "*Assam Hitaishi*" (1926), "*Abahan*" (1929) and "*Jayanti*" (1938). published science articles and news in a regular basis. The famous Assamese litterateur Kaliram Medhi made science efforts to create an environment of scientific temperament among the readers by writing a series of science articles in *Assam Bandhav* and *Alochani*. *Darwinar mator jatkinchit abhas* (An introduction to the ideas of Darwin; published in *Assam Bandhav*, Vo. 3, No. 4,1912), *Helir nejal Tara* (Hailey's comet; published in *Assam Bandhav*, Vo. 1, No. 8 & 9,1910), *Prithivi* (the World; published in *Alochani*), *Surya* (the sun), *Baidyutik Paramanu* (ion), *Pani aru Baraf* (Water and Ice; published in *Bahin,* Vol. 20, No. 01, p. 35) were some of the topics discussed from scientific point of view in these magazines. *Bahin* gave special stress on science and technology section. On the other hand, the journal, "Asom Chatra Sanmilani" *Milan* (1922) started to publish various science news and awareness stories. In an article published in *Milan* (Vol. 6, No. 2) on the journey to the moon in the section *Bijnan Jagatar Jilingani* a science communicator encouraged the general people

with the last line – " whatever the case may be, that men will one day reign supreme on the moon, is certain." In addition to that, *Jayanti* (1938) promoted the social awareness as to scientific developments. In the pre Independence era, all magazines and newspapers published and covered science and technology news. It is only a haldful popular magazines like *Usha and Asom Pradipika* that did not give much attention to science news.

Sarbeswar Sarma Kataki, Lakshmi Prashad Chaliha, Sarat Ch. Goswami, Lakshminath Das, Saifuddin Ahmed, Mahananda Barua, Birinchi Kumar Barua, Nagendranath Phukan, Girish Ch. Barua, Damudar Hazarika, Nalini Kumar Mishra, Dimbeswar Neog, Kiran Ch. Goswami were some successful science writers of this period, who tried to create an environment to popularize science.

3.3.4 Post independence era

India attained freedom in 1947. The post independence era marks further development in the spread of science journalism in Assam. In the post Independence period some new areas of science and technology communication occupied space in the magazines and the newspapers of the state. *Bijnan Baichitra* was a regular column published in *Ramdhenu (*popular Assamese magazine*)* and have a series of articles on psychology were published. *Amar Pratinidhi ,* another magazine introduced and continued a special column named *Bijnanstambha. Sadiniya Navayug,* yet another weekly magazine had two important sections titled *Swasthyar Sitanat* (Health Section) and *Bijnanbedya* (Science). Children magazines like *Akash, Safura, Mukuta, Mouchak, Abiskar, Jnan-Bijnan* etc. also tried to attract the children's attention to science issues and thereby develop this interest in science in general. Dr. Dinesh Chandra Goswami, a popular contemporary science writer, wrote a science based children's novel entitled *Tritonar Abhijan* for *Mukuta.*



CHECK YOUR PROGRESS

Q.1: ..... is the first Assamese science book.

Q.2: ..... the first Indian journal to carry science and technology information.

Q.3: Assamese science journalism started with .....

3.4 SCIENCE MAGAZINES IN ASSAM

The first Assamese science magazine is *Pashu palan* -edited and published by Dr. Kanak Chandra Sharma which deals with the subject of agriculture and veterinary science. This magazine was published every month from 1925 to 1948. During the period from 1939 to 1961 there were about 30 science books that greatly enriched the Assamese science literature. In 1953 we can see the establishment of Assam Science Society, a volubility organization dedicated to the cause of science in Assam. It can take legitimate credit for popularizing science in Assam. *Bigyan Jeuti*, the second exclusive science magazine in Assamese language was published in 1962 by Assam Science Society and from that time onwards, *Bigyan Jeuti* have been playing the most vital role in the development of Assamese science literature. Some of the other science magazines published in seventies are – *Deh-man* (1970), *Swasthya Pradip* (1971), *Lahar* (1973-74), *Spandan* (1974-75), *Padartha Bigyan Patrika* (1975), *Bigyan Rasana* (1976), *Bigyan Barnali* (1979-80), *Bigyan Patra* (1979), *Bigyan Barta* (1979), *Jnan Bigyan* (1979) etc. Nuclear (1981), *Dristi* (1982), *Bigyan Safura* , *Bhougolika* (1985), *Abiskar* (1987), *Natun Abiskar* (1988) were published in the eighties. In the last decade of the twentieth century only two three science magazines were published.

In the present decade a large number of science magazines have been published but most of the recent science magazines are basically health based. The AIDS Control Society, the Public Health department and the National Rural Health Mission are engaged in creating a health awareness campaign in the state. It is a very positive sign for the growth of

science journalism in Assam which aims at making the general people science literate. But it is unfortunate that most of the media and publishing houses are not interested in publishing pure science magazines. Health continues to occupy the major space among scientific writings.

During this period a section of monthly magazines like *Prakash, Sutradhar, Prantik etc. have* offered space for covering scientific topics and thereby contributing in no mean way to the popularization of science among the literate class of people. It is also worth mentioning that the articles published in these magazines are written in a simpoel and easily digestible writing style. Dr. Paramananda Mahanta a noted academic says that we can divide the writing ways or genre of these magazines into three types : the pure and applied science writings; the descriptive science writings; and news based science writings.

But in recent times, science communication sections in other Assamese magazines are comparatively negligible except in a few magazines like *Prantik*. A thorough analysis is required about the coverage of science stories in the family and commercial magazines in Assam. From such on analysis we have seen that *Prantik* regularly dedicates a large section to science and technology, followed by *Satsari* with at least 5 % of its total space to science and technology. Some other commercial magazines like P*riyo Sakhi, Trisnatur, Rahashya, Saparibar, Jiban* etc. allocate a minimum space for science. It includes basically health sections. On the other hand, a large number of magazines do not publish any science and technology stories. Some of them are *Gariyashi, Nandini, Bismoy* and *Maya.*



3.5 LET US SUM UP

In this unit you have been introduced to the topic of science communication in Assam. Let us analyse some of the important points as given below-

- The beginning of the concept of science communication in Assam can be traced to the pre Orunodoi era and even earlier than that

going by the evidence of scientific ideas scatterd in the sayings of Daka Purush in 4th and 5th century.

- The post Orunodoi and post independence periods have witnessed a remarkable growth in terms of publications and readership.
- Bakul Kayastha translated a popular book on Mathematics namely Kitab Manjuri in 1434. Bakul Kayastha therefore can be regarded as the first Assamese science writer and Kitab Manjuri as the first Assamese science book.
- The post Orunodoi era covers the period from early twentieth century to independence.
- The first Assamese science magazine is Pashu palan -edited and published by Dr. Kanak Chandra Sharma which deals with the subject of agriculture and veterinary science.
- In 1953, the Assam Science Society was established.
- Bigyan Jeuti, the second exclusive science magazine in Assamese language was published in 1962 by Assam Science Society



3.6 FURTHER READING

1. Dutta, Ankuran and Anamika Ray (2011), *Science Communication in Assam*, DVS Publishers, Guwahati



3.7 ANSWERS TO CHECK YOUR PROGRESS

Ans. to Q. No. 1: Kitab Manjuri

Ans. to Q. No. 2: Digdarshan

Ans. to Q. No. 3: Orunodoi



3.8 MODEL QUESTIONS

A. Short Questions (Answer each question in about 150 words)

Q. 1: Enumerate the impoprtance of Daka's sayings.

Q. 2: Write a note on Bijyan Jeuti.

B. Long Questions (Answer each question in about 300-500 words)

Q. 1: Discuss science communication in Assam with special reference to post orunodoi era.

Q. 2: Discuss the contribution of 'Orunodoi' in communicating science in Assamese literature.

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UNIT 4: SCIENCE WRITING

UNIT STRUCTURE

4.1 Learning Objectives
4.2 Introduction
4.3 Writing Science News
4.4 Sources of Scientific Information
4.5 Qualities of a science news reporter
4.6 Writing Science Features and Articles
4.7 Writing Science Fiction
4.8 Let Us Sum Up
4.9 Further Reading
4.10 Answers to Check Your Progress
4.11 Model Questions

4.1 LEARNING OBJECTIVES

After going through this unit, you will be able to -

- understand the different types of science writings
- have a brief idea about the science news and basic qualities of a science news reporter
- learn about science features, articles and science fictions.

4.2 INTRODUCTION

Scientific publication is an important component of literature. What people observed in nature in the early days of scientific research, or worked in the laboratory were communicated to the public either in oral forms (like debates and discussions) or through publications. Royal Society of London is the pioneer in encouraging such scientific writings. Today, with the advancements of science and technology in various fields (Physical, Chemical, Biological, Environmental, Health etc.), the need for scientific writing has gained more importance. Equally, the growth of research and journals, newspapers and other popular sources has expanded the horizon for science writers.

A good science reporter should be a good storyteller for the audience. We should remember that there are different expectations from scientists and audiences while writing on science. Science writer is a bridge between these two vital organs of his writing. It is therefore essential that the science news is not framed with jargon. At the same time, there should not be any distortion to the facts while doing simplification of terminology.

4.3 WRITING SCIENCE NEWS

Science is a part of beat reporting resembling other areas of beats in journalism, like politics, culture, sports etc. As such, the basic elements of news writing (the 5Ws - Who, What, Where, When, Why and 1 H - How) remains constant for the construction of science news as well. Other features like headline, credit line/byline, lead and body are an essential part of science news too. Figure 4.1 is an example of Science News (environmental) with different elements. The news elements remain constant in formulating science news.

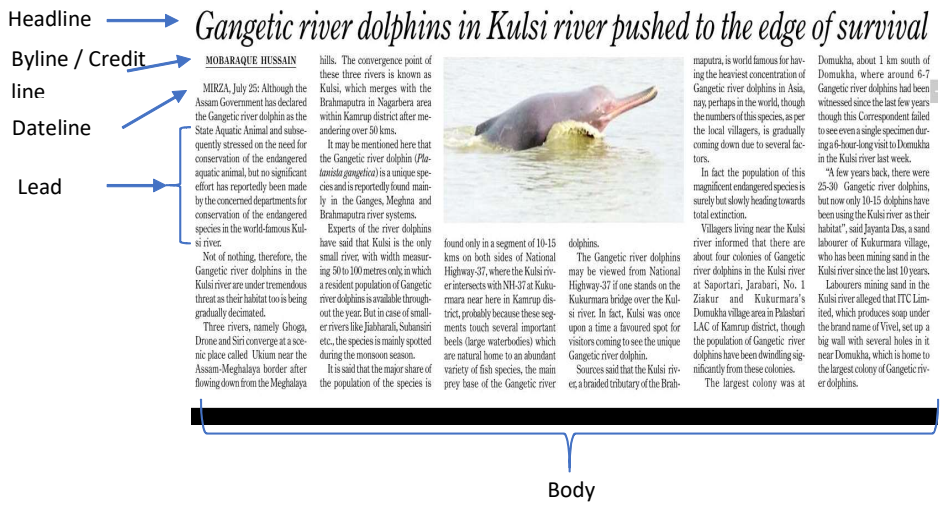


Figure 4.1: Elements of Science News (*Source*: The Assam Tribune, May 26, 2021)

Science falls under the **category** of *hard news* when it explains new inventions, findings and discoveries. It can be classified as *soft news* when the writing style amalgamates both information and entertainment. This type of news may be some time old in terms of findings or discoveries but

may be relevant in some *context*. For example, the celebration of World Environment Day can be categorized as hard news on 5th June every year. This is because each year the motto of the day differs, people may celebrate the day with innovative ideas and government may adopt new schemes. But when news is written on e.g., *how the quality of air has been degraded in the last five years and its effect on the human body* on the same day or focusing on the life or work of scientists on a significant date, it can be termed as soft news. Therefore, understanding of *hard news* and *soft news* of journalism is a prime requirement in science news writing as well.

Science News is written in *inverted pyramid style* like other hard news in journalism. In an inverted pyramid style of writing, the most important facts are placed at first followed by the less important details in the body. However, this rule can be modified on some occasions, where elaborate description becomes essential to write a news story. This is termed the *narrative style* of news writing.

An interesting style of science news reporting is that usually, news very often begins with summarizing facts from primary scientific sources like research papers. '...scientists have found that…', '...in a recent paper published in…by scientists…' are some of the common languages of science news. The lead of science reporting may be written in a *simple statement*, *bullet leads style*, *narrative lead* and *surprised* or *paradox lead*.

Discussing What makes a good science story, Nancy Baron in her book *Escape from the Ivory Tower: A Guide to Making Your Science Matter*, identifies a few qualities of good science news. These are *novelty* (what is new and surprising), *passion* (of a journalist), *adventure* (exotic locales, wild animals, extreme weather, and triumphs over difficult circumstances etc.), *overturning conventional wisdom* (present reader with the unexpected), *conflict and controversy* (from both public and scientist's expectation), *just plain cool* (making the story appealing with research and investigations "…look at your work with fresh eyes. What would someone who knows nothing about it find weird, fascinating, or just plain cool?'' example of programmes includes: *Quirks and Quarks*, the Canadian Broadcasting Company's science show, *Turning Point* and *Earth Matters*- the programmes

by Doordarshan) *It's Not Necessarily the Whole Story* ("Journalists are usually looking for a "bite" of the story rather than the entire history and chronology of any particular scientific discovery. Thinking in terms of bite-sized pieces can go a long way toward helping journalists find a story that will work for them, their editors, and their audiences").

In science journalism, a reporter should remember that two different expectations work in science news framing: (a) expectations from scientists/ scientific communities and (b) expectations of the public. Scientists expect that people should know the background of their research, their methods while discussing their results. On the other hand, the public needs new findings in the field of science (Figure 4.2). Detail background of methods is not always necessary for the public. Therefore, maintaining the balance of these two expectations remains a challenge for a science reporter.

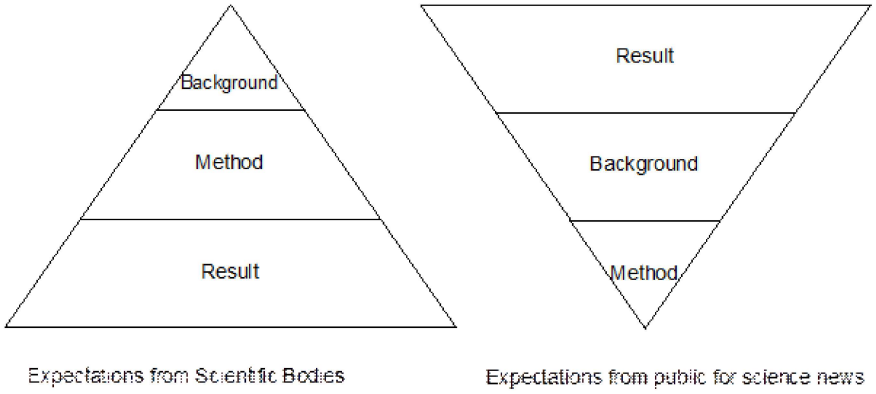


Figure 4.2: A science reporter has to maintain the balance between the expectations of both the scientific body and the public.

4.4 SOURCES OF SCIENTIFIC INFORMATION

Science information can be collected from various sources. Recent technological enhancements have changed the earlier unidirectional model of scientific sources into a multi-dimensional one. The addition of social media sites like blogs and micro-blogging sites such as Twitter has broadened the prospect for science reporters. Professor Bruce V. Lewenstein from Cornell University USA, a pioneer in science and technology communication, in his commentary on "Taking Our Own Medicine: On an

Experiment in Science Communication" (2011), mentioned various spheres of Science Communication. Some of these are Government reports, Policy documents, Research news, Websites, Seminars, Lab/Fieldwork, Journals, Meetings, Documentaries, museums, General books, Entertainment media (movies, sitcoms, games), Park Visitor Centers, Patents, Reference works etc. These all are good sources of science reporting. Apart from these, interviews with scientists, community efforts/individual efforts, crises (examples - environmental crisis, health crisis, natural calamities etc.) also make reliable news sources on many occasions (Figure 4.3).



Figure 4.3: Sources of scientific information/news

Like other branches of journalism, it is always the instinct and knowledge for the news of a reporter that helps him to find breaking news.

Before preparing a science report, the following steps must be remembered by science reporters for accuracy and objectivity of news:

(a) **Finding a good source**: Most scientific reporting appears as a result of findings by scientists which get published in academic journals. All the scientific articles might not make a good story all the time. Therefore, the reporter needs to find out which story will be relevant and interesting for the audience.

(b) **Reading the scientific article**: Reading the scientific article leads the reporter to apprehend his story. Ivan Sample, science correspondent of *The Guardian* writes, 'You need to read the introduction for context, the discussion and conclusions for take-home messages, check the methods to find weaknesses and flaws. Also, it is important to spend time on the results. Have the authors omitted key data? Look at odds ratios, error bars, fitted curves and statistical significances. Are the results robust? Do they back up the scientists' conclusions? Read the supplementary material too.

(c) **Verifying the content**: Before writing, a reporter should verify the content. In this era of fake information, there is overflow of information. As such, a reporter should have an inquisitive mind. For verifying the content, the reporter may directly talk to the writer or may take interviews of other experts from a similar field (the *primary data*). On other occasions, a reporter may also consult materials published earlier (like books/monographs/reviews) or can surf the authentic internet sources (*the secondary data*).

(d) **Understanding of the subject**: Before writing, a reporter should ask himself, do I understand the subject well? If one does not understand the subject matter, it is difficult to explain it clearly to the audience. Moreover, it may lead to wrong presentation of news. For example, while reporting news on *black fungus*, a regional newspaper wrote a headline that, 'Cases of black fungus virus are been reported' (Figure 4.4). This is a wrong headline as; Fungus and Virus are two different types of microorganisms with different features. Such mistakes lead to the loss of credibility for both writer and the media house.


অসমত ভয়াৱহ 'ব্লেক
ফাংগাছ' ভাইৰাছৰ উপস্থিতি
বিশেষজ্ঞক
প্রতিবেদন দাখিল
কৰিবলৈ নির্দেশ
স্বাস্থ্য মন্ত্রীৰ

Figure 4.4 Understanding of a subject is important for science writing

(e) **Target audience**: A good writer always remembers the nature of his audience before finalizing the matter.

(f) **Knowing the media**: Every medium has different characteristics of writing. Writing for print medium differs from radio, television and web-based media. Hence, the science reporter must know the type of media he/she is writing for.

(g) **Building the message**: Building the message is a challenge to every science reporter. Comprehending science news is often difficult for common readers. Therefore, the science writer needs to write in a simple language with coherent information. Before the construction of the content framework, the writer should ask himself, 'why my writing should be read by the audience?' In addition, if you can add a relevant picture and photograph to your story, this will generate more interest in the mind of the audience.

4.5 QUALITIES OF A SCIENCE NEWS REPORTER

In his article *Who are the science journalists*? for National Geographic, Ed Young states, 'science journalism is the oeuvre of those who are specifically assigned to write about science'. Considering the amount of responsibility a science reporter has, Young further comments that '…depending on who you ask, they are (*the science journalists*) either the unsung heroes of science outreach or the villains of the piece with blood on their hands.' This is because, many a time, science reporters misunderstand a subject, misquote scientists or media organizations wrongly place a report without understanding the context.

Science reporting is a challenging task. Fiona Fox of the UK's Science Media Centre described science journalism as "a common set of standards including selection, investigation, truth-telling, independence, editing, accuracy, balance, scrutiny, objectivity and so on."

Discussing the need of science journalism and the role of science journalists, Khalil A. Cassimally, in his article, *3 Essential Qualities Up-and-coming Science Writers Should Develop* for *Scientific American* wrote, "communicating science to as many readers as possible is very important especially considering the challenges mankind will face soon. By encouraging non-scientist readers to read (and engage with) science, science writers (*or science journalists here*) can sensitize those readers about the importance and sheer awesomeness of scientific research. In turn, those readers, as citizens, can make more informed decisions as they lobby or elect policymakers".

In a world, dominated by science and technology, science journalists, therefore, have great responsibilities. Qualities of a good science reporter need all the conventional qualities of a reporter along with an interest to communicate science to the public.

(a) **Interest:** The prime requisite of a science reporter is - interest in the subject. In contrast to other branches of journalism, the potential of science journalism has been exponentially proliferated in recent

years due to increased investments of Governments and private organizations in scientific research worldwide. New findings in scientific research every day makes science reporting challenging as well as exciting. Great science writers such as Walter Sullivan of the New York Times, and many of the leading science writers of the world, were self-taught, due to their interest in science communication. Science, as a subject, is considered sometimes dull and in other times, as monsters by people. It is therefore essential that before choosing science journalism as a career, a reporter must ensure that he/she has an interest in the subject.

(b) **An appetite for reading**: What late Anthony Tucker, former science editor of the British newspaper *The Guardian* once stated is relevant for science reporters or science writers. According to Tucker, science journalists, 'like all other journalists, must have an insatiable appetite for reading."

(c) **Investigation/ research skills:** A science reporter should have investigative skills for verifying the content before publishing.

(d) **Aptitude for analysis:** A science reporter should have the aptitude to analyse the issues objectively. Findings of new research, its applicability, positive or negative impacts etc. should be the priority of a science reporter as many scientific inventions are directly related to life in the earth in general and humans in specific. Valuing the *context* of research, therefore, holds significance in science reporting. The reporter should learn how to read like a reader before learning how to read like a writer.

(e) **Knowledge:** Knowing what is happening around is significant but science reporting gets momentum if the journalist has prior knowledge of a subject and knows the history or background of the incidents. This is like the stepping stone for a science reporter as prior knowledge helps a reporter to analyze an event from various perspectives.

(f) **Respecting deadline:** Deadline in science reporting may be of two types:

- Timeliness of an event
- Deadline from organization

As news is the most perishable thing in the world, it is essential to know the timeline of an event. A science reporter should be prepared to report a new happening at once. If needed, a reporter should visit the field to gather information and supporting materials in support of the story. For example, if some animals die in a locality, a science reporter has to consult with concerned departments, experts and local people (if needed), immediately. Likewise, in case of disasters like nuclear blasts, fire in a laboratory, health issues, the science reporter's job is to report an event at the earliest so that necessary measures can be taken to control the situation. A science reporter must not forget that a delayed reporting may not find a news position in a media organization. Maintaining the deadline of the organization is indispensable in science reporting.

(g) **Establishing Network**

Every science reporter wants to make a breaking story. To get first-hand knowledge of happenings, a science reporter should be able to establish a good relationship with scientists and other sources from scientific organizations so that the bonding turns into a strong network for him/her. Moreover, a strong network is always beneficial in case of a follow-up story.

(h) **Command over the language:** A science reporter should have effective communication skills to persuade the minds of the audience. Once the topic is understood, the science reporter should be able to express his idea lucidly. The key coin of a science journalist's connection with the audience is his/her communication skill only. What kind of story you are writing and in which language you are addressing also matter for a science reporter? If you are doing a translation, then you should be conscious so that the meaning does not change and you can maintain the original quality of the author.

(i) **Ethics:** Ethics always remain the backbone of good journalism. Ethics is the morality that defines what is correct or acceptable and what is not. Media ethics rests on both legal and societal dimensions. What is legally acceptable may not be tolerable in a pluralistic country like India on every occasion. This is why media should be concerned about its role as a mirror of society. Studies show that many developmental initiatives failed in developing countries due to non-acceptability from a society. This crucial behaviour at the community level ought to be understood by a science reporter before framing the content. Science in most of the time interwined with culture. This makes the job for a science reporter arduous to differentiate between *duties* and *responsibilities*. This is why a science reporter will have to find out the best possible balanced way to spread the information maintaining social responsibility.

(j) **Is training in science or science communication mandatory**?

Almost all the established science writers of our time believes that having a science degree or training in science is not a mandatory qualification for a science journalist. While asking this question to Mariette DiChristina, the editor-in-chief of *Scientific American* during that time, (It is the oldest continuously published magazine in the United States) at the 2013 American Association for Advancement of Science (AAAS) Annual Meeting Communicating Science seminar, she said, "…science writers the world over have different backgrounds: Some are PhDs, some are journalists, and some have an engineering degree. Any kind of science training is helpful, but in the field, it's not the be-all and end-all. Today, the younger reporters seem to have at least a bachelor's degree in a science discipline and often a master's degree in science writing. But we come at science journalism from all sorts of backgrounds. Scientists devote huge chunks of their lives to knowing something in great depth and detail, and the journalist will know nothing so well, so I can see how we keep scratching our heads at each other. At the end of the day, however, we're all – both scientist and journalist – seeking knowledge".

K. S. Jayaraman, former science correspondent, the Press Trust of India in his article *How do I become a science journalist?* also said that "... Recruiters, however, do not always insist on degrees or diplomas in science journalism. They mostly look for zeal for science writing and the ability to write science stories in a way that the general public can understand".



CHECK YOUR PROGRESS

Q.1: Who is K. S. Jayaraman?

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Q.2: Name two acclaimed science journalists of the world.

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4.6 WRITING SCIENCE FEATURES AND ARTICLES

Science Features

Features are types of journalistic writing which are based on facts but written in an elaborate, simplified manner for popular consumption on contemporary issues. Feature writers have more freedom than a reporter to cover a subject in an interpretative way. Features are generally read during leisure hours. Hence, the sole aim of a feature is to inculcate the interest of readers towards a subject. The language of feature should be eloquent, fluent and simple. Sometimes, a feature may be presented in a dramatized narrative. The feature is a favourable format in radio broadcasting.

Features go beyond the facts, includes findings of research from a similar field, interviews or individual interpretations and opinions, thereby implanting deeper imagination in the audience mind.

Like other journalistic features, science features may be of different types:

(a) News features (focusing on a subject of recent interest),

(b) Personality feature (biographical write up in general)

(c) Historical feature (based on historical shreds of evidence. Historical science features are considered as one of the most popular types of scientific features these days)

(d) Adventure features (Based on adventures of environmental activists. Such types of features easily grab readers of environmental magazines)

(e) Photo features: A narrative presented through photographs are becoming a widely popular feature attracting readers spontaneously. As visuals are gaining popularity, newspapers and magazines prefer to tell a story through photographs. You should remember that photographs are considered a hundred times more powerful than words.

(f) Features on other issues of public interest: Any topic on human interest can be presented as a feature.

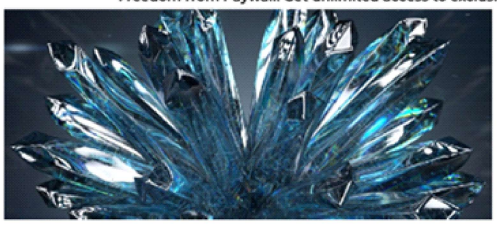
THE ECONOMIC TIMES Panache
English Edition | 20 August, 2021, 09:41 PM IST | E-Paper

Scientists develop new material that repairs itself without external intervention

Synopsis
Called bipyrazole organic crystals, the piezoelectric molecules self-heal in milliseconds.



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Cluster of raw piezoelectric crystals 3D (Representative Image)

NEW DELHI: Scientists have developed piezoelectric molecular crystals that repair their own mechanical damage without the need for any external intervention, the Department of Science and Technology (DST) said on Saturday. Piezoelectric crystals are a class of materials that generate electricity when it undergoes a mechanical impact.

Devices that are used daily often break down due to mechanical damage, forcing users either to repair or replace them. This decreases the life of the equipment and increases maintenance costs. In many cases, like in a spacecraft, human intervention for restoration is not possible.

"Keeping such necessities in mind, researchers from the Indian Institute of Science Education and Research (IISER) Kolkata, in collaboration with IIT Kharagpur, have developed piezoelectric molecular crystals that repair themselves from mechanical damages without need for any external intervention," the DST said in a statement.

Today, there exists professional organizations called *feature syndicates* which provide well-documented features on a wide range of subjects. Newspapers and other media organizations prefer such features as convenient, immediate and trustworthy to rely on for their publications.

Science Articles

There are large varieties of different scientific articles published by journals. Their names may vary depending upon the publisher. The various author service section of scientific publishing houses generally provides three categories for scientific articles: ***Primary scientific articles*** **(based on primary research, popularly called as 'paper'),** ***secondary scientific articles*** **(based on primary sources. Examples includes books, reviews, monographs etc.),** *Tertiary or popular scientific literature* (targeted for popular consumption and hence published in magazines and newspapers). We shall know about these three categories elaborately in Unit 11.



CHECK YOUR PROGRESS

Q.3: What is a 'feature syndicate'?

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Q.4: Give examples of secondary scientific information.

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4.7 WRITING SCIENCE FICTION

Science fiction, popularly termed Sci-fi is an imaginative storytelling approach related to scientific inventions, discoveries, catastrophizes etc. in the future timeline. Such write up may be types of books, films, novels, stories, drama etc. Bruce Sterling defines science fiction as a form of fiction that deals principally with the impact of actual or imagined science upon society or individuals. The term *science fiction* was popularized in the 1920s

by the American publisher Hugo Gernsback. For his contribution, the Hugo Award is given annually since 1953 by the World Science Fiction Society. These achievement awards are given to the top SF writers, editors, illustrators, films, and fanzines (Britannica.com).

Scientific fictions contain plots, sub-plots, time and space, environment, sequences, settings, diction, as well as characters through which writers construct an imaginative story with a scientific base. It is interesting to note that many of the nineteenth-century sci-fi became reality in the twentieth and twenty-first centuries. For example, 'Knight Riders'- a detective TV show projected a car having supercomputer operations leading to auto functioning of the car. Today, it has become a reality. Jules Vern's book 'From the Earth to the Moon' (1865) described the story of three men who prepared a projectile to reach the surface of the moon before it happened in reality.

Today, sci-fi films have become the most popular movie genre among the cine-goers. Examples include A Trip to the Moon (1902), Frankenstein (1931), 2001: A Space Odyssey (1968), Solaris (1972), Star Wars (1977), E.T. the Extra-Terrestrial (1982), Jurassic Park (1993), Avatar (2009), Gravity (2013), Interstellar (2014) etc. Like the fields of science, sci-fi movies are also becoming diverged about a theme, scientific elements, visual effects and imagery.

French sci-fi writer Jules Gabriel Verne (1828-1905), is considered as the 'father of the science fiction, alongside his English contemporary H. G. Wells (1866-1946) (Cairns, 2020, CNN). Mary Shelly's widely acclaimed book 'Frankenstein' (1918) is considered one of the pioneering works in the field of sci-fi. In India, 'The Runway Cyclone' (1896) by Jagadish Chandra Bose is considered the first example of Indian sci-fi literature. Renowned Marathi writer Jayant Narlikar, legendary filmmaker Satyajit Ray, Hindi writers Naval Bihari Mishra, Yamuna Dutta Vaishnava, Kailash Saha and many others have contributed to the growth of sci-fi in the country. Assamese science fiction literature dates back to Hari Prasad Baruah's story "Birasotiyar Desh" (1937). Some of the prominent science fiction writers of Assamese literature are – Dinesh Chandra Goswami, Ranju Hazarika, Bandita Phukan,

Abhijit Sarma Barua, Santanu Tamuli among others. *Axomiya Kalpabijnan Galpa Sankalan*, an anthology of Assamese science fiction stories (compiled and edited by Santanoo Tamuly) and brought out by *Sahitya Akademi* (2018) is remarkable addition in understanding the evolutionary trend of sci-fi writing in Assamese.

Rising numbers of popular publications like magazines, newspapers, books, digital platforms have accelerated the popularity of sci-fi literature these days. Some popular sci-fi writers of all times of the world are Jules Verne, Isaac Asimov, Arthur C. Clarke, H. G. Wells, Ray Bradbury, Mary Shelly, Douglass Adams and others.



CHECK YOUR PROGRESS

Q.5: Give three examples of sci fi movies.

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Q.6: Who wrote the book, 'From the Earth to the Moon' (1865)?

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4.8 LET US SUM UP

- Science is a part of beat reporting resembling other areas of beats in journalism. As such, all the elements of news are also visible in science news.
- Before writing science news, science reporters should check it for the accuracy and objectivity of content.
- Science news can be collected from various sources. Like other branches of journalism, it is always the nose for the news of a reporter that helps him to find a breaking news

- Interest, an appetite for reading, research skills, knowledge, respecting deadline: establishing a network, command over the language, respect for ethics are considered as some of the basic qualities of a science reporter.
- The basic objective of Scientific writings like features, articles and science fiction is to disseminate scientific information in a reader-friendly way so that science does not remain Greek for common people.



4.9 FURTHER READING

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4.10 ANSWERS TO CHECK YOUR PROGRESS

Ans. to Q. No. 1: K. S. Jayaraman is the former science correspondent of the Press Trust of India.

Ans. to Q. No. 2: Walter Sullivan of the New York Times and Mariette DiChristina, the editor-in-chief of *Scientific American.*

Ans. to Q. No. 3: Feature syndicates are professional organizations that provide well-documented features on a wide range of subjects that are taken by news organisations.

Ans. to Q. No. 4: Examples of secondary scientific writings are: **books, reviews, monographs.**

Ans. to Q. No. 5: Examples of sci-fi movies are: 'Star Wars, 'Jurassic Park' and 'Day After Tomorrow'.

Ans. to Q. No. 6: The book was written by *Jules Gabriel Verne.*



4.11 MODEL QUESTIONS

A. Short Questions (Answer each question in about 150 words)

Q. 1: What are the sources of science news?

Q. 2: What are the sources of scientific information? Mention with examples.

Q. 3: What are the various types of science features?

B. Long Questions (Answer each question in about 300-500 words)

Q. 1: State the basic qualities of a good science news reporter.

Q. 2: What are the basic steps that a science reporter should adopt before presenting science news to maintain credibility? Discuss.

Q. 3: What are the qualities of good science news, according to Nancy Baron? Illustrate with examples.

Q. 4: Discuss the important steps a reporter should remember before preparing science news.

Q. 5: What are the elements of science news? Identify the elements of science news from the given example.

*** ***** ***

UNIT 5: SCIENCE AND TECHNOLOGY POLICY IN INDIA

UNIT STRUCTURE

5.1 Learning Objectives

5.2 Introduction

5.3 Science and Technology Policy in India

- 5.3.1 Scientific Policy Resolution of 1958
- 5.3.2 Technology Policy Statement of 1983
- 5.3.3 Science and Technology Policy 2003
- 5.3.4 Science ,Technology and Innovation Policy 2013

5.4 Let Us Sum Up

5.5 Further Reading

5.6 Answers to Check Your Progress

5.7 Model Questions

5.1 LEARNING OBJECTIVES

After going through this unit, you will be able to-

- analyse the concept of Science and Technology Policy
- explain the different Science and Technology policies of India.

5.2 INTRODUCTION

In the previous unit, you have been introduced to the basic concept of science communication along with the history of science journalism in India. In this unit, you will be given a brief overview of the science and technology policy in India .

5.3 SCIENCE AND TECHNOLOGY POLICY IN INDIA

Science and economic development of a country go hand in hand. They are in fact interrelated. India has come a long way since it attained independence way back in 1947. Since then the government of India has been strongly aware of both needs - the need to build up a powerful science

base and the need to ensure that science is not only restricted to the university laboratories and other scientific organisations. Under the leadership of some illustrious leaders India managed to steadily climb up the ladder of success in the field of science and technology. Be it Rakesh Sharma's epoch making experience of being the first Indian to travel in space ,C.V Raman's contribution in the field of Physics or the Pokhran tests, India has managed to etch its name among the world's elite. The economic reforms of the 1990's opened up new vistas of development and planning with special emphasis laid on the development of Information and Communication Technology. India has been able to build up a capacity in a wide range of areas of modern technology , from software engineering to heath biotechnology. This has enabled the country to engage itself in the global knowledge economy and deliberate on certain issues pertaining to dissemination of scientific knowledge. The key to national prosperity lies in the effective utilisation and combination of three factors - technology, raw materials and capital . Among them, human capital can be considered to be the pedestal on which the wealth and prosperity of a nation depend on. For effective utilisation of human capital for industrialisation , specialised technical and training skills are necessary.

It is necessary to have a robust and full-fledged science and technology policy in place in order to chart out a path towards scientific and economic development. The first such policy was taken in 1958 which is known as the Scientific Policy Resolution of 1958. This was followed by the Technology Policy Statement of 1983, Science and Technology Policy of 2003 and the latest being Science, Technology and Innovation Policy of 2013. Now let us discuss in brief some of the important policies of Science and Technology of the Indian Government.

5.3.1 Scientific Policy Resolution of 1958

The policy laid emphasis on the cultivation of science and scientific research in its three aspects – pure, applied and educational. It also aimed at providing the best possible training to research scientists and other technical personnel who would contribute towards nation building.

The SPR, 1958 resolved to *"foster, promote and sustain"* the*" cultivation of science and scientific research in all its aspects"*. It was assumed that the technology would *"flow"* from the country's established science infrastructure. Let us now look at the aims of the Scientific Policy Resolution of 1958 as has been stated by the Government of India-

a. to foster, promote and sustain, by all appropriate means, the cultivation of science, and scientific research in all its aspects- pure, applied and educational

b. to foster, promote, and sustain, by all appropriate means, the cultivation of science, and scientific research in all its aspects - pure, applied, and educational;

c. to ensure an adequate supply, within the country, of research scientists of the highest quality, and to recognize their work as an important component of the strength of the nation;

d. to encourage, and initiate, with all possible speed, programmes for the training of scientific and technical personnel, on a scale adequate to fulfil the country's needs in science and education, agriculture and industry, and defence;

e. to ensure that the creative talent of men and women is encouraged and finds full scope in scientific activity;

f. to encourage individual initiative for the acquisition and dissemination of knowledge, and for the discovery of new knowledge, in an atmosphere of academic freedom; and in general, to secure for the people of the country all the benefits that can accrue from the acquisition and application of scientific knowledge.

5.3.2 Technology Policy Statement of 1983

The Scientific Policy Resolution of 1958 gave the much needed impetus towards building a strong agricultural and industrial base as well as a scientific manpower which is impressive in quality ,

numbers and range of skills. Special emphasis was given on the development of right form of technology in accordance with the needs of the society covering the agricultural and the service sectors along with the manufacturing sector. Manufacturing sector covers a wide spectrum of areas ranging from small scale industries to the medium and heavy industries. Thus technology must be implemented taking into account various economic, social and cultural factors so that it is properly utilised in the different sectors. This Technology Policy Statement is in response to the need for guidelines to cover this wide-ranging and complex set of inter-related areas. The basic objective of this policy was the development of indigenous technology and efficient absorption and adaptation of imported technology appropriate to national priorities and resources. The aims of this policy are-

a. attain technological competence and self-reliance, to reduce vulnerability, particularly in strategic and critical areas, making the maximum use of indigenous resources
b. provide the maximum gainful and satisfying employment to all strata of society, with emphasis on the employment of women and weaker sections of society
c. use traditional skills and capabilities, making them commercially competitive
d. ensure maximum development with minimum capital outlay
e. identify obsolescence of technology in use and arrange for modernisation of both equipment and technology
f. develop technologies which are internationally competitive, particularly those with export potential
g. improve production speedily through greater efficiency and fuller utilization of existing capabilities and enhance the quality and reliability of performance and output
h. reduce demands on energy, particularly energy from non-renewable sources

i. ensure harmony with the environment, preserve the ecological balance and improve the quality of the habitat; and

j. recycle waste material and make full utilization of by-products.

The Technology Policy of 1983 emphasized on the need to attain technological competence and self-reliance. By self-reliance we mean relying on one's power and resources rather than depending on others. This policy espoused this very concept of self-reliance whereby optimum utilisation of resources would be stressed on. This would go a long way in reducing the overdependence on other developed nations for procurement of resources and technology. In order to achieve this objective, the role of different agencies has to be identified, responsibilities assigned and necessary linkages must be established.

In order to be self-reliant, the technology base needs to be strengthened where manpower training would be accorded pride of place. It was mentioned in the policy that special attention would be accorded to the promotion and strengthening of the technology base in newly emerging and frontier areas such as information and materials sciences, electronics and biotechnology. However, this calls for substantial financial investments and strengthening of the linkages between various sectors such as educational institutions, research and development establishments, and industry and government machinery.

Technology Policy Statement of 1983 had drawn up certain priorities as given below-

Need for Perspective Planning

In order to develop any form of technology it is necessary to draw up a proper plan where requisite investments can be made in relevant areas without much wastage. It was categorically stated that the cost and time element involved in the import of technology and indigenous development will be given consideration. Moreover, those ministries concerned with large investments and production

activities in areas like food, health and energy was said to be provided with appropriate technical support though suitably structured science and technology groups.

Employment

One of the important thrust areas of the policy was the employability of the workers. It was said that conditions would be created for the full utilization of scientific talent. Special emphasis would be given for the improvement of standards of living of those engaged in traditional activities while diversification of labourers in the decentralized sector will be done in order to reduce drudgery.

Energy

Energy is one of the most important and scarce input that is necessary for running industrial houses and other agriculture based industries. It was said that measures would be taken to avoid wastage or non-optimal use of energy. Thus, research and development in the energy sector will aim at improving the efficiency of its production, distribution and utilization , as well as improvement of efficiency of its production, distribution and utilization as well as improvement of efficiency in processes and equipment.

Efficiency and Productivity

Technology which has already been employed by a number of industries will be evaluated on a continuous basis in order to realise maximum benefits in terms of increased production and lower costs, specially in the public-sector enterprises.

In the field of development of technology, it was mentioned that special emphasis would be laid on food, health, housing, energy and industry. This has been cited below-

- agriculture including dry-land farming;
- optimum use of water resources, increased production of pulses and oilseeds;
- provision of drinking water in rural areas, improvement of nutrition, rapid reduction in the incidence of blindness,

eradication of the major communicable diseases (such as leprosy and tuberculosis) and population stabilization;

- low-cost housing;
- development and use of renewable non-conventional sources of energy; and industrial development

5.3.3 Science and Technology Policy 2003

Science and technology have has unprecedented impact on economic growth and social development. It has made its presence felt in almost all the sectors be it in social sector, economic or scientific sector. Scientific and technological developments today also have deep ethical, legal and social implications. The ongoing globalisation and the intensely competitive environment have a significant impact on the production and services sectors.

The Science and Technology Policy of 2003 marked a paradigm shift from the earlier policies. It addressed the issues related to the field of science and technology together. It emphasized on Research and Development ("**R&D**") for addressing national problems and calls for integrating programmes of socio-economic sectors with the national Research and Development system. It also articulated upon the need for technological innovation and creation of a national innovation system. The main objective of the policy which was launched in January, 2003 was to raise India's overall research intensity from 0.80% of GDP in 2003 to 2.0% of GDP by the end of the tenth five year plan. Even though it fell short of the target, yet the GDP/GERD ratio stood at 0.88% in 2007.

The main objectives of the Science and Technology 2003 policy are –

a. To ensure that the message of science is disseminated to each and every citizen of India so that they can participate and contribute their ideas in the development of science and technology.

b. To ensure food, agricultural, nutritional, environmental, water, health and energy security of the people on a sustainable basis.

c. To mount a direct and sustained effort on poverty alleviation, enhancement of livelihood security, removal of hunger and malnutrition, reduction of regional imbalances and generation of employment by incorporating scientific tools and techniques.

d. To foster and encourage scientific research in universities and other academic, scientific and engineering institutions by attracting the brightest young minds

e. To promote women empowerment and facilitate their participation in the field of science and technology

f. To provide necessary autonomy and freedom of functioning for all academic and R & D institutions so that a perfect ambience is created which is conducive for work.

g. To make use of science and technology to protect, preserve , evaluate and update the extensive knowledge acquired over the long civilizational experience of India

h. To accomplish national strategic and security-related objectives by using the latest advances in science and technology

i. To encourage research activities in areas relevant to the economy and society like agriculture, water, health, education, industry etc.

j. To establish an Intellectual Property Rights (IPR) regime which maximises the incentives for the generation and protection of intellectual property by all types of inventors.

k. To ensure that efforts are made to have high speed access to information at affordable costs

l. To encourage research studies for prevention and mitigation of natural hazards.

m. To promote science and technology cooperation at the international level.

Primary and secondary education in Science and Technology are critical in building up a scientific community in the long run. This is because, if proper training and education are not provided at the base level to the budding scientists, then it will be difficult to induct them in the different science and technology based sectors in the near future. An important initiative was taken in this policy whereby it was decided that infrastructure for science and engineering in the academic institutions would be modernized. Emphasis would be made on the development of science laboratories in schools and colleges.

A major initiative to modernize the infrastructure for science and engineering in academic institutions will be undertaken. It will be ensured that all middle and high schools, vocational and other colleges will have appropriately sized science laboratories. Science, engineering and medical departments in academic institutions and universities and colleges will be selected for special support to raise the standard of teaching and research. To begin with, a significant number of academic institutions, specially the universities, as also engineering and medical institutions, would be selected for this support to make an impact. Flexible mechanisms for induction of new faculty in key areas of science would be developed.

5.3.4 Science ,Technology and Innovation Policy 2013

Science, Technology and Innovation Policy 2013 is one of the important science and technology policies as instituted by the Department of Science and Technology, Government of India. Science, Technology and Innovation can be said to be the main drivers of economic development the world over. Technology and innovation stems from science which in turn is responsible for heralding the growth of science and technology globally including India. The Scientific Policy Resolution(SPR) of 1958 resolved to 'foster, promote and sustain' the 'cultivation of science and scientific research in all its aspects'. The Science and Technology Policy (STP) of 2003 brought science and technology together and emphasized

the need for investment in research and development. This policy called for integrating programmes of socio-economic sectors with the national research and development system to address national problems as well as creating a national innovation system.

Science, Technology and Innovation Policy (STI) 2013 is of utmost importance because having a proper policy in place sets the momentum for the growth of indigenous technology based industries and manpower. The previous policies mainly focussed on having a sound base on science and technology. The policy of 2013 laid special emphasis on innovation which can be said to be an act of introducing new methods, ideas or products. In this context, it implies science and technology based solutions that are successfully deployed in the economy or the society. Thus, innovation has assumed centre stage in the developmental goals of the country. It is worth mentioning here that India has declared 2010-20 as the 'Decade of Innovation'. So, the government of India stressed on the need to come up with a policy to synergize science, technology and innovation and subsequently established the National Innovation Council (NInC).

STI Policy : A new paradigm

It goes without saying that science, technology and innovation co-exist together and their integration leads to new value creation. India's position on the world map will be determined by its performance in the field of science and technology. Thus, resources need to be tapped and utilised in a proper way. This would go a long way in generating a balanced and sustainable development. New mechanism must be adopted and models must be developed in order to address the pressing challenges of energy, environment, nutrition, water and sanitation, healthcare, skill development and unemployment. 'Innovation for inclusive growth' is the new catchphrase as it implies ensuring success, and availability and affordability of solutions to a large section of population. This policy will give the much needed push towards investment in science based projects and innovation in select areas of socio-economic importance.

Thus, the key elements of the Science, Technology and Innovation Policy are listed below-

- Promoting the spread of scientific temper amongst all sections of society
- Enhancing the skill for applications of science among the youth from different sections of the society
- Charting careers in science, research and innovation specially for the bright young minds
- Establishing world class infrastructure for research and development in order to gain global leadership in select areas of science
- Positioning India among the top five global scientific powers by 2020
- Linking contributions of science, research and innovation system with inclusive economic growth agenda and combining priorities of excellence and relevance.
- Creating an environment for enhanced Private Sector Participation in the field of research and development
- Enabling conversion of research and development (R & D) outputs into societal and commercial applications by replicating hitherto successful models as well as establishing of new PPP(Public Private Partnership) structures
- Seeding science and technology (S & T) based high risk innovations through new mechanisms
- Fostering resource-optimized, cost effective innovations across size and technology domains
- Triggering changes in the mindset and value system to recognise, respect and reward performances which create wealth from knowledge derived from science and technology
- Creating a robust national innovation system

Investment in Research and Development

'Economic superpower' is a term that is meant for those countries which have abundant supply of resources at their disposal and the necessary technology backed by well trained scientists and technicians. It is known to all and sundry that technology , specially indigenous must be given more emphasis. As compared to global investments in science, technology and innovation, India's R & D investment is less. Both the public and the private sector must pump in more and more money in research activities specially in the field of science and technology.

As per the 2011-12 Research and Development Statistics Report of the Ministry of Science and Technology, Government of India , the gross expenditure on Research and Development (GERD) in the country has been consistently increasing over the years and has doubled from 24,117.24 crores in 2004-05 to Rs.53,041.30 crores in 2009-10. It is estimated to be Rs. 62, 053.47 crores in 2010-11 and Rs. 72,620.44 crores in 2011-12. The gross budgetary support for the science and technology sector has significantly increased during the last decade. The impact of such increase is becoming evident. India ranks ninth globally in the number of scientific publications and 12th in the number of patents filed. The Composite Annual Growth Rate (CAGR) of Indian publications is around 12±1% and India's global share has increased from 1.8% in 2001 to 3.5% in 2011.

Summing up, we can say that the different science and technology policies of India over different periods of time have had a deep impact on the economy of the country. Such policies set the motion for the development of science and technology. The twelfth five year plan (2012-17) had laid emphasis on the development and growth of science and technology. It said that technology partnerships must be built with States through new models of technological solutions, design, development and

delivery. It further stated that creation of Peta-scale supercomputing facilities must be given due focus and large Indian industries must be encouraged to establish globally benchmarked Research & Development centres. It is worth mentioning here that the Union Budget for the year 2015-16 have earmarked Rs. 1500 million for the purpose of research and development. This shows that the country has taken up the cause of the development of science and technology on a war footing with special emphasis on developing Institutes of excellence.



CHECK YOUR PROGRESS

Q.1: What are the three factors on which the prosperity of a country depends upon?

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Q.2: What was the name of the first science and technology policy of India and when was it implemented?

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Q.3: Which decade has been designated by India as the 'Decade of Innovation'?

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Q.4: What is the importance of having a science and technology policy?

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5.4 LET US SUM UP

- The key to national prosperity lies in the effective utilisation and combination of three factors - technology, raw materials and capital .
- Human capital can be considered to be the pedestal on which the wealth and prosperity of a nation depend on.
- The scientific policy resolution of 1958 laid emphasis on the cultivation of science and scientific research in its three aspects - pure, applied and educational.
- The Technology Policy of 1983 emphasized on the need to attain technological competence and self-reliance.
- The Science and Technology Policy of 2003 marked a paradigm shift from the earlier policies. It addressed the issues related to the field of science and technology together.
- Science , Technology and Innovation Policy (STI) 2013 is of utmost importance because having a proper policy in place sets the momentum for the growth of indigenous technology based industries and manpower.



5.5 FURTHER READING

1. Heptulla, Najma (1986) , *India's progress in science and technology*, Oxford and IBH Pub. Co.
2. Nanda, J.N (2004), *Science and Technology in India's Transformation*, Concept Publishing Company, New Delhi
3. Singh, Ashok Kumar (2008*), Science and Technology for Civil Services Examinations,* Tata McGraw-Hill, New Delhi

5.6 ANSWERS TO CHECK YOUR PROGRESS

Ans. to Q. No. 1: The key to the prosperity of a country lies in the effective utilisation and combination of three factors - technology, raw materials and capital .

Ans. to Q. No. 2: The name of the first science and technology policy of India was 'Scientific Policy Resolution'. It was implemented in the year 1958.

Ans. to Q. No. 3: The decade from 2010-2020 has been designated by India as the 'Decade of Innovation'.

Ans. to Q. No. 4: Science and Technology Policy is an integral part for the development of any country. It is necessary to have a robust and full-fledged science and technology policy in place in order to chart out a path towards scientific and economic development. This sets the momentum for the growth of indigenous technology based industries and manpower.

5.7 MODEL QUESTIONS

A. Short Questions (Answer each question in about 150 words)

Q. 1: What is the importance of having a robust science and technology policy in place ?

Q. 2: What are some of the priorities that the Technology Policy Statement of 1983 had drawn up ?

Q. 3: What are the main objectives of the Science and Technology 2003 policy ?

B. Long Questions (Answer each question in about 300-500 words)

Q. 1: "Primary and secondary education in Science and Technology are critical in building up a scientific community in the long run" - Explain.

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UNIT 6: SCIENCE AND TECHNOLOGY SET-UP IN INDIA

UNIT STRUCTURE

6.1 Learning Objectives

6.2 Introduction

6.3 Science and Technology System in India

6.4 Central Government Science and Technology Departments/ Ministries

6.5 Science and Technology in NGOs

6.6 Science and Technology Departments/Councils in the State Government

6.7 Recognised in-house R & D units

6.8 Let Us Sum Up

6.9 Further Reading

6.10 Answers to Check Your Progress

6.11 Model Questions

6.1 LEARNING OBJECTIVES

After going through this unit, you will be able to :

- comprehend the science and technology system in India
- get a brief overview of the different branches of the science and technology system in India.

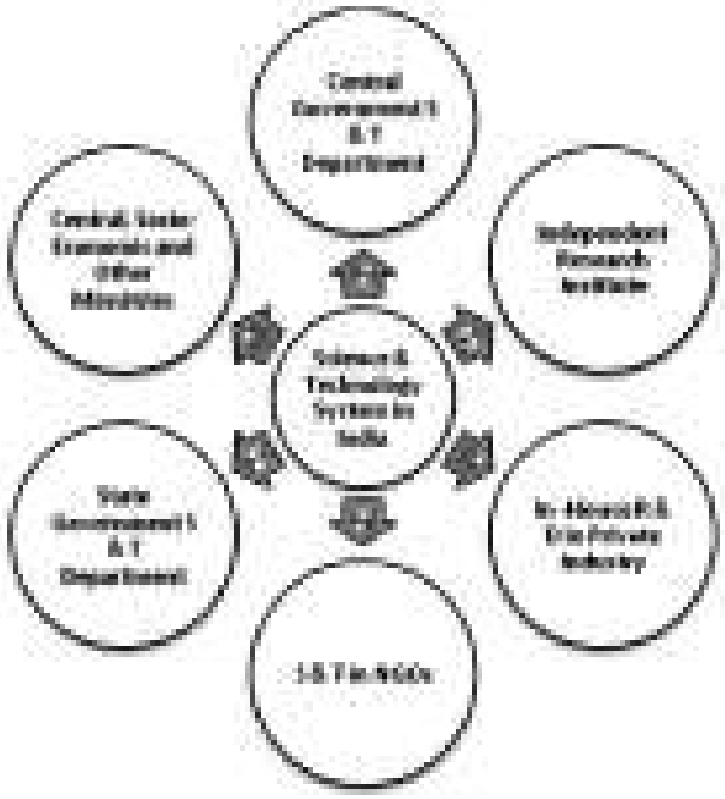
6.2 INTRODUCTION

India has a robust science and technology system in place in order to set the momentum for the growth of indigenous technology based industries and manpower. We have already come across the different science and technology policies of India with the latest policy being implemented in 2013. These policies have set the pace for the rapid expansion and growth of scientific institutions in different parts of the country

along with development of manpower. In order to carry on research activities at a higher level and to imbibe scientific temperament in the minds of the people, several departments were set up by the Indian government. This has resulted in a broad-based and extensive S&T network. Along with the setting of the numerous departments, emphasis was also given on developing adequate and trained manpower. Science and Technology infrastructure in India encompasses S&T organisations under the Central Government, State Government as well as public and private sectors working in areas as diverse as agriculture and healthcare on the one hand and nuclear and space research on the other.

6.3 SCIENCE AND TECHNOLOGY SYSTEM IN INDIA

A brief overview of the science and technology system in India has been cited below-



Source : Department of Science and Technology, Ministry of Science and Technology, Government of India (www.dst.gov.in)

As is evident from the figure given above, India's science and technology system is divided into six different divisions- Science and Technology Department under the Central Government, Independent Research Institute, In-House Research and Development in Private Industry, Science and Technology system/departments in the non-governmental organisations, Science and Technology department under State Government and science and technology system under central, socio-economic and other ministries. The actual development of the science and technology movement took shape post Independence and Pt. Jawaharlal Nehru was instrumental in popularising science and technology. This resulted in the setting up of many science and technology departments in the country in a phased manner. The departments of Atomic Energy, Science and Technology, and Space were thus among the first S&T departments set up in the country . Consequently, the Council of Scientific and Industrial Research expanded with the establishment of various institutions dedicated to the development of specific industries. There are different branches of the science and technology system in India which we shall describe in the following sub-heads.

6.4 CENTRAL GOVERNMENT SCIENCE AND TECHNOLOGY DEPARTMENTS/MINISTRIES

The Science and Technology departments functioning under the Central Government are : Department of Science and Technology (DST), Department of Scientific & Industrial Research (DSIR), Department of Atomic Energy (DAE), Department of Space (DoS), Department of Biotechnology (DBT) and Department of Ocean Development (DOD). Department of Science and Technology is mainly entrusted with the responsibility of formulation of Science and Technology policies and their implementation, identification and promotion of thrust areas of research in different sectors of science and technology; technology information, forecasting and assessment; international collaboration, promotion of science & society programmes and coordination of science and technology activities in the country.

The Government of India have different designated departments related to the field of science and technology under different ministries. Under the Ministry of Science and Technology, we have Department of Science and Technology, Department of Biotechnology and Department of Scientific and Industrial Research. Ministry of Earth Sciences (MoEs) which was earlier known as Ministry of Ocean Development came into being vide Presidential Notification dated the 12th July, 2006 bringing under its administrative control India Meteorological Department (IMD), Indian Institute of Tropical Meteorology (IITM) and National Centre for Medium Range Weather Forecasting (NCMRWF). It is worth mentioning here that initially Department of Ocean Development (DoD) was created in July 1981 which functioned as a nodal Ministry for organising, coordinating and promoting ocean development activities in the country. However, in February, 2006 the Department came to be known as the Ministry of Ocean Development which was later changed into Ministry of Earth Sciences. Under Ministry of Agriculture we have two autonomous organisations/body – Indian Council of Agricultural Research (ICAR) and Central Agricultural University and one company by the name of Agrinovate India Limited. Apart from the above mentioned ministries, there are also some departments which are related to the field of science and technology - Department of Atomic Energy (DAE) and Department of Space (DOS) . Apart from some of the important departments related to the field of science and technology, there are other ministries which makes use of technology in different fields like Ministry of Food Processing Industries and Ministry of New and Renewable Energy. Let us analyse some of the important departments/ministries/organisations which have been engaged in undertaking research and development in different areas of science and technology

- **Department of Science and Technology** (**DST**), established in May 1971, is a department within the Ministry of Science and Technology in India. It tries to promote new areas of science and technology and to play the role of a nodal department for organising, coordinating and promoting Scientific and Technological activities in the country through a number of autonomous institutions and

professional bodies. For instance , Institute of Advanced Study in Science and Technology (IASST) is one such autonomous institute situated in Guwahati which is engaged in research activities pertaining to the field of science and technology. Apart from that, the department is also responsible for providing funds to various approved scientific projects in India.

- **Department of Scientific and Industrial Research (DSIR)** which was set up on 4th January, 1985 under the Ministry of Science and Technology, carries out the activities relating to indigenous technology promotion, development, utilization and transfer. It has two autonomous organisations – **Council of Scientific and Industrial Research (CSIR) and Consultancy Development Centre (CDC).** CSIR is said to be India's largest research and development organization. DSIR also acts as the nodal department for granting recognition to in-house R&D units in Industry and Scientific and Industrial Research Organizations (SIROs). CSIR, constituted in 1942 is known for its cutting edge R&D knowledgebase in diverse S&T areas, is a contemporary R&D organization. CSIR covers a wide spectrum of science and technology – from radio and space physics, oceanography, geophysics, chemicals, drugs, genomics, biotechnology and nanotechnology to mining, aeronautics, instrumentation, environmental engineering and information technology. Consultancy Development Centre (CDC) is mainly meant for promotion and development of Consulting Profession with focus on capacity building, consulting human resources, Studies on State of Consulting Activities in certain domain areas, identifying opportunities for Export of Consultancy Services and facilitating availability of consultants and client organisations. DSIR has two important PSUs – National Research Development Corporation and Central Electronics Limited.
- **Department of Biotechnology (DBT),** set up in 1986 under the Ministry of Science and Technology is basically responsible for identifying and supporting specific R&D programmes in the field of

biotechnology and biotechnology-related product manufacture. It also provides support and training of young scientists in the field of biotechnology at various universities and institutes. This department has made significant achievements in the growth and application of biotechnology in the broad areas of agriculture, health care, animal sciences, environment, and industry. DBT has 15 autonomous institutions and 3 Public Sector Undertakings (PSUs). A few important autonomous institutions are National Institute of Immunology (New Delhi), National Brain Research Centre (Haryana), National Centre for Cell Science (Pune), Institute of Life Sciences (Bhubaneshwar) and Rajiv Gandhi Centre for Biotechnology (Kerala). The three PSUs are Bharat Immunological & Biological Corporation(Uttar Pradesh), Indian Vaccine Corporation Limited (New Delhi) and Biotechnology Industry Research Assistance (New Delhi).

North Eastern Region – Biotechnology Programme Management Cell (NER-BPMC) is a programme of the Department of Biotechnology, Ministry of Science & Technology, Government of India for development, coordination and monitoring of biotechnology programmes in the North Eastern States of India managed by the Biotech Consortium India Limited (BCIL), New Delhi. The NERBPMC which was established by DBT in 2009 helps to evolve and implement various new programmes in the area of biotechnology for the benefit of the north eastern states. In order to create an environment of training and research in Medical Biotechnology, the department provides support to 12 medical colleges in ths region. About 92 Biotech hubs have already been established at various institutions , universities and colleges to promote education, training and research in biological sciences including biotechnology.

- **Department of Atomic Energy (DAE) came into being on** August 3, 1954 under the direct charge of the Prime Minister through a Presidential Order. This department has been engaged in the development of nuclear power technology, applications of radiation technologies in the fields of agriculture, medicine, industry and basic research. DAE comprises of six research centers, three industrial

organizations, five public sector undertakings and three service organizations. It has under its aegis two boards for promoting and funding extra-mural research in nuclear and allied fields, mathematics and a national institute (deemed university). It also supports eight institutes of international repute engaged in research in basic sciences, astronomy, astrophysics, cancer research and education. It also has in its fold an educational society that provides educational facilities for children of DAE employees. The main Research & Development centres under DAE includes Bhabha Atomic Research Centre (Mumbai), Indira Gandhi Centre for Atomic Research(Kalpakkam), Raja Ramanna Centre for Advanced Technology (Indore), Variable Energy Cyclotron Centre (Indore), Global Centre for Nuclear Energy Partnership (Gurgaon) and Atomic Minerals Directorate for Exploration and Research (Hyderabad).Some of the important DAE aided institutions include Tata Institute of Fundamental Research(Mumbai), Saha Institute of Nuclear Physics (Kolkata), Institute of Physics (Bhubaneshwar) and Institute of Mathematical Sciences (Chennai).

- The Government of India constituted the Space Commission and established the **Department of Space (DOS**) in June 1972 and brought Indian Space Research Organisation under DOS in September 1972. This department has been created with the prime objective of promoting development of space science & technology towards achieving self-reliance and for space applications facilitating all-round development of the country. It also manages several agencies and institutes related to the field of space exploration and space technologies. DOS operates through a major set-up, the Indian Space Research Organisation, which is responsible for planning and executing a viable space programme to develop satellites and launch systems and provide space-based services in the areas of communication, meteorology, resources survey, management and sustainable development. Different programmes are implemented by the Department of Space (DOS) through, mainly, Indian Space

Research Organisation (ISRO), Physical Research Laboratory (PRL), National Atmospheric Research Laboratory (NARL), North Eastern-Space Applications Centre (NE-SAC) and Semi-Conductor Laboratory (SCL). The Centres of Indian Space Programme are situated in 23 places all over India including one in Shillong known as the North Eastern Space Application Centre. These centres undertake research activities in the field of space technology. RESPOND (Research Sponsored) programme started in the 1970s, aims at encouraging academia to participate and contribute in various space related activities. Under RESPOND, projects are taken up by Universities/academic institutions in the areas of relevance to Space Programme. Apart from this, ISRO has also set up Space Technology Cells at premiere institutions like Indian Institute of Technologies (IITs) - Bombay, Kanpur, Kharagpur and Madras; Indian Institute of Science (IISc), Bengaluru and Joint Research Programme with University of Pune to carry out research activities in the areas of space technology and applications.

- **Department of Agricultural Research and Education (DARE)** under Ministry of Agriculture was established in December, 1973. **The Indian Council of Agricultural Research (ICAR)** is an autonomous organisation under the Department of Agricultural Research and Education (DARE). Formerly known as Imperial Council of Agricultural Research, it was **established on 16th July 1929** and is responsible for co-ordinating, guiding and managing research and education in agriculture including horticulture, fisheries and animal sciences in the entire country. With 100 ICAR institutes and **70 agricultural universities** spread across the country this is one of the largest national agricultural systems in the world. ICAR has also been instrumental in ushering Green Revolution across the country. It is engaged in cutting edge areas of science and technology development under the guidance of the internationally renowned scientists. Apart from ICAR, there is one more autonomous body under Department of Agricultural Research and Education

known as the **Central Agricultural University** in Imphal. Established in 1993, the university has integrated programmes of teaching, research and extension education with its jurisdiction spread over Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Sikkim and Tripua. Department of Agricultural Research and Education also owns a company by the name of Agrinovate India Limited which is a registered company under the Companies Act, 1956. The company aims to work on the strengths of ICAR and promote the development and spread of research and development outcomes through IPR protection, commercialization and gorging partnerships both within and outside the country.

- **The Indian Council of Medical Research (ICMR),** New Delhi is another apex body in India which has been set up for the formulation, coordination and promotion of biomedical research. Funded by the Government of India through the Department of Health Research, Ministry of Health & Family Welfare, this Council conducts research in different fields like control and management of communicable diseases, maternal and child health, control of nutritional disorders, developing alternative strategies for health care delivery, research on non-communicable diseases and drug research. In fact, the Council promotes biomedical research in the country through intramural as well as extramural research.
- **Defence Research and Development Organisation (DRDO)** is the Research and Development arm of the Ministry of Defence, Government of India. Set up in 1958, DRDO today has 46 laboratories which are situated in the length and breadth of the country. On the basis of the R & D work carried out by the laboratories, its activities can be grouped into seven technology clusters – Armament and Combat Enginering Systems (ACE), Aeronautical Systems (AERO), Missiles and Strategic Systems (MSS), Naval Systems and Materials (NS & M), Electronics and Communication Systems (ECS), Micro Electronic Devices and Computational Systems 9MED & CoS) and Life Sciences (LS). Thus, the main mandate of DRDO is to provide

assessment and advice on scientific aspects of weapons, platforms and surveillance sensors; to develop cutting edge technologies to be used in the production of state-of-art sensors, weapon systems, platforms and allied equipment for our defence services.

- The Ministry of Earth Sciences was established in the year 2006 by bringing all the agencies of meteorological and ocean development activities under one umbrella. The Earth System Science Organization (ESSO) addresses holistically various aspects relating to earth processes for understanding the variability of earth system and for improving forecast of the weather, climate and hazards. The ESSO is also responsible for development of technology towards the exploration and exploitation of marine resources in a sustainable way for the socio-economic benefit of the society. The policies and programmes of the ESSO are pursued through mission mode projects through its centres, viz. India Meteorological Department (IMD), National Centre for Medium Range Weather Forecasting (NCMREF), Indian Institute of Tropical Meteorology (IITM), National Centre for Antarctica and Ocean Research (NCAOR), National Institute of Ocean Technology (NIOT), Indian National Centre for Ocean Information Services (INCOIS), National Centre for Earth Science Studies (NCESS), Centre for Marine Living Resources and Ecology (CMLRE) and Integrated Coastal and Marine Area Management (ICMAM).
- Research & Development activities of **the Ministry of New and Renewable Energy** aim at resource assessment, technology development, demonstration and commercialization. The Ministry supports Research, Design, Development and Demonstration (RDD&D) to develop new and renewable energy technologies, processes, materials, components, sub-systems, products & services, standards and resource assessment so as to indigenously manufacture renewable energy devices and systems. The underlying purpose of RDD&D efforts is to make industry competitive and renewable energy generation supply self-sustainable/profitable and thereby contribute to increase share in total energy mix in the country.

A comprehensive policy on Research, Design, Development and Demonstration (RDD&D) is in place to support RD&D in new and renewable energy sector, including associating and supporting RD&D earned out by industry for market development. The said policy includes complete RDD&D perspective in solar energy envisioned in Jawaharlal Nehru National Solar Mission (JLNNSM), which envisages India as a global leader in solar energy, by creating the policy conditions for its diffusion across the country as quickly as possible.

- **Department of Electronics and Information Technology** (DeitY) is an important department under the Ministry of Communications & IT, Government of India . The vision of this department is to promote e-Governance for empowering citizens, promoting the inclusive and sustainable growth of the Electronics and IT , enhancing India's role in Internet Governance, promoting Research and Development and innovation, enhancing efficiency through digital services and ensuring a secured cyber space. Three important areas have been identified for the purpose of Research and Development - Information Technology, Convergence Communications & Broadband Technologies, and Electronics.
- **Ministry of Environment, Forest and Climate Change :** Since its inception in 1985, the Ministry of Environment, Forest and Climate Change has been funding research through grant-in-aid projects to many research institutions in different areas under the broad ambit of environmental protection and management. The Ministry has taken a number of new initiatives to strengthen scientific research in the area of environmental sciences. Research and Development takes place through different programmes like Environmental Research Programme (EnvRP), Ecosystems Research Programme (EcRP), Research Programmne in Socio-Economic Issues of Environment (RPSE). There are also a few research based autonomous organizations under the Ministry like Govind Ballabh Pant Institute of Himalayan Environment and Development, Indian Council of Forestry Research and Education, Indian Institute of Forest

Management, Indian Plywood Industries Research and Training Institute and Wildlife Institute of India. These organizations carry out different research activities related to environmental issues.

6.5 SCIENCE AND TECHNOLOGY IN NGOS

Non-Governmental Organisations (NGOs) also serve as important organisations for carrying out research activities in the field of science and technology. They contribute to different stages of the research cycle, fostering the relevance and effectiveness of the research, priority setting, and knowledge translation to action. They play a key role in stewardship (promoting and advocating relevant issues of research), resource mobilization for research, generation, utilization and management of knowledge, and capacity development.

People's Science Institute is an NGO situated in Dehradun which has been working in the fields of community-led watershed-based livelihoods development, environmental quality monitoring, disaster-safe housing and dissemination of appropriate technologies. Research is undertaken to improve the implementation of field projects, identify new areas of work and to innovate new technologies and social processes.

Applied Environmental Research Foundation is another NGO based in Pune. The foundation uses makes use of research techniques in order to plan, prioritise and manage activities within its programmes. The research based strategies enable the foundation to improve management practices, make informed decisions and aid local people in managing their resources better.

6.6 SCIENCE AND TECHNOLOGY DEPARTMENTS/ COUNCILS IN THE STATE GOVERNMENT

Even though there are numerous departments at the centre to monitor and look into the science and technology sector, yet for proper implementation of development goals, the need to establish State Councils for Science and Technology was stressed on. As such, the initiative to

establish State Councils for Science & Technology was first taken way back in 1971 when Shri C Subramaniam, the then Minister for Science and Technology and Chairman, National Committee for Science and Technology (NCST) wrote to Chief Ministers of all the States implying the importance of focusing on the States in order that the development goals are attained. The end of the Fifth five year plan saw the establishment of State S & T Councils in Karnataka, Kerala, Uttar Pradesh and West Bengal. However, it was felt that a sustained effort was necessary in order to develop more State Councils for Science and Technology. As such, the subsequent five year plans laid emphasis on the development of such State Councils through the plan programme 'Assistance for development of State Councils for Science and Technology'. This gradually led to the setting up of several State Science and Technology Councils in all the States and Union Territories. The State Councils are usually chaired by Chief Ministers of respective States or by an eminent scientist.

It is worth mentioning here that the Department of Science & Technology (DST), Government of India played a positive role in facilitating the setting up of the State Science and Technology Councils. DST's support has facilitated State S&T Councils to embark upon novel initiatives resulting in a number of success stories.

Let us take the example of Assam's Science & Technology Department in order to understand the working of the different functionaries. The Science and Technology Department of Assam which was established in 1983 is the nodal Department for the promotion of Science and Technology in the State. The main objective of the department is to initiate, support, promote and co-ordinate research and development projects which can be utilised for the overall development of the State. The Department also tries to implement various schemes of the Indian Government, North Eastern Council and other public bodies relevant to the areas of science, technology and environment . The Department also implement various schemes/programme through its subordinate organisations institutions like Assam Science and Technology council (ASTEC), Assam Energy Development Agency (AEDA), Centre of Plasma Physics- Institute for Plasma Research (CPP - IPR) and Institute of Advanced Study in Science and Technology (IASST).

6.7 RECOGNISED IN-HOUSE R & D UNITS

Apart from the above mentioned departments and ministries of the government of India, there are also other in-house research and development units of both private and public sector. As per the March, 2023 directory of the Department of Scientific and Industrial Research, there are 831 Scientific and Industrial Research Organisations recognised by DSIR which are engaged in the research and development activities. These centres channelize their research activities towards product development, process development, commercialisation of indigenous technologies and absorption and up-gradation of imported technologies. There are also about other scientific and industrial research organisations in the country which have been engaged in research and development in the field of natural and applied sciences, agricultural sciences, social sciences and medical sciences.

Apart from the above mentioned various departments, research and development activities under the private industries , R & D activities in the NGOs, and state science and technology departments have been established to carry out research work pertaining to the field of science and technology.

Thus, we can say that the science and technology system in India is a robust one with different government sectors, institutions, agencies, NGOs, departments engaged in undergoing research and development activities in various fields. It is worth mention9ing here that as per the national research and development survey carried out in 2011, there were about 4533 R & D institutions out of which 50 % of the institutions were found to be in the Private Sector, 20% in State Sector, 14% in Central Sector, 12% in Universities and the remaining 4 % in the Public Sector.

In the field of basic research, the country has done notably and has established major research groups with world-class capabilities in various emerging and frontline areas of Science & Technology. Some examples are the areas of Molecular Biophysics, Molecular Biology, Neuro-biology, Liquid Crystals, Biomedical Devices, Superconductivity,

Condensed Matter Physics, Astronomy and Astrophysics, Powder Processing and Advanced Materials, Organic Chemistry, Solid Sate and Surface Chemistry, Numerical Weather Prediction, Parallel Processing and Atmospheric Sciences.

India occupies a unique position in the world having formulated its own nuclear programme and cultivated self-reliance in areas of reactor technology and its entire associated fuel cycle. The country designs, constructs and operates nuclear reactors, fabricates the required fuel -- reprocesses it, and treats the waste generated in the entire fuel cycle in a comprehensive manner by a totally indigenous effort.

Yet another achievement which speaks of the high level of S&T capability of India is the development of supercomputers which only a few advanced countries have this capability today.

A large number of technologies have been developed and commercialized for various chemicals, including petrochemicals and agrochemicals; industrial catalysts; drugs and pharmaceuticals; biomedical devices; food processing; leather processing and products; engineering materials and equipment; electronic equipment and construction materials, to cite a few. Many of these technologies have also been marketed abroad, an indication of their global competitiveness.



CHECK YOUR PROGRESS

Q.1: When was the Department of Science and Technology established ?

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Q.2: Name the two autonomous under Department of Scientific and Industrial Research (DSIR).

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Q.3: What is the function of NER-BPMC programme?

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Q.4: When was the Ministry of Earth Sciences established?

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6.8 LET US SUM UP

- Department of Scientific and Industrial Research (DSIR) which was set up on 4th January, 1985 under the Ministry of Science and Technology, carries out the activities relating to indigenous technology promotion, development, utilization and transfer.
- Department of Biotechnology (DBT), set up in 1986 under the Ministry of Science and Technology is basically responsible for identifying and supporting specific R&D programmes in the field of biotechnology and biotechnology-related product manufacture.
- The Indian Council of Agricultural Research (ICAR) is an autonomous organisation under the Department of Agricultural Research and Education (DARE).
- The Indian Council of Medical Research (ICMR), New Delhi is another apex body in India which has been set up for the formulation, coordination and promotion of biomedical research.
- Defence Research and Development Organisation (DRDO) is the Research and Development arm of the Ministry of Defence, Government of India.
- The Science and Technology Department of Assam which was established in 1983 is the nodal Department for the promotion of Science and Technology in the State.



6.9 FURTHER READING

1. Heptulla, Najma (1986) , *India's progress in science and technology*, Oxford and IBH Pub. Co.
2. Nanda, J.N (2004), *Science and Technology in India's Transformation*, Concept Publishing Company, New Delhi
3. Singh, Ashok Kumar (2008*), Science and Technology for Civil Services Examinations,* Tata McGraw-Hill, New Delhi



6.10 ANSWERS TO CHECK YOUR PROGRESS

Ans. to Q. No. 1: May 1971

Ans. to Q. No. 2: Council of Scientific and Industrial Research (CSIR) and Consultancy Development Centre (CDC).

Ans. to Q. No. 3: North Eastern Region - Biotechnology Programme Management Cell (NER-BPMC) is a programme of the Department of Biotechnology, Ministry of Science & Technology, Government of India for development, coordination and monitoring of biotechnology programmes in the North Eastern States of India managed by the Biotech Consortium India Limited (BCIL), New Delhi. The NERBPMC which was established by DBT in 2009 helps to evolve and implement various new programmes in the area of biotechnology for the benefit of the north eastern states.

Ans. to Q. No. 4: 2006



6.11 MODEL QUESTIONS

A. Short Questions (Answer each question in about 150 words)

Q. 1: What are the main activities that are carried out by the Department of Scientific and Industrial Research?

Q. 2: How do the Non-Governmental Organisations (NGOs) serve as important organisations for carrying out research activities in the field of science and technology?

B. Long Questions (Answer each question in about 300-500 words)

Q. 1: Give a brief overview of the science and technology system in India.

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UNIT 7: SCIENCE COMMUNICATION MEDIA

UNIT STRUCTURE

7.1 Learning Objectives

7.2 Introduction

7.3 Print Media

- 7.3.1 Newspapers
- 7.3.2 Magazines
- 7.3.3 Books

7.4 Audio-visual Media

- 7.4.1 Radio
- 7.4.2 Television

7.5 Folk Media

7.6 Interactive Media

7.7 Media on wheels

7.8 Few observations

7.9 Let Us Sum Up

7.10 Answers to Check Your Progress

7.11 Further Reading

7.12 Model Questions

7.1 LEARNING OBJECTIVES

Following a thorough and comprehensive study of this unit, you shall be able to -

- effectively understand the significance of various media used for science communication
- know the advantages and disadvantages of different media employed for this purpose
- analyse which particular medium should be or can be used for a specific cause
- comprehend whether a combination of different media may prove to be more suitable for addressing a particular problem

- know how to prepare a suitable Media Plan for launching a science communication campaign
- design messages and communicate various science-related matters

7.2 INTRODUCTION

Selection of the right type of media for spreading various aspects of science and technology is a highly important exercise. This is because many a times an important and potentially-effective message may lose its relevance if it is portrayed in the not so relevant media. Like in many other areas of life, here also media can't be chosen like a one size fits all categories of population. That is why there is an important concept termed 'media planning' that is so significant in this field also. This concept is a detailed and comprehensive plan to utilize various media in a combined manner to publicise something. The goal is to get the maximum benefits garnered from the activity. This plan is based on prior experiences in those fields by persons concerned so that an almost full-proof plan can be prepared successfully delivering the messages to the right segment of the population or the Target Audience. Further, it is needless to say that without media the whole exercise would prove meaningless as the messages will not be able to reach humanity. It is worth mentioning here that the society possesses huge repositories or stocks of knowledge in basic and applied sciences and technological areas over the centuries and decades. These are being developed in the different laboratories belonging to independent research and development organizations, universities etc. Some of these basic knowledge sources may not be directly applicable or beneficial to human beings. Yet a vast majority of them can definitely 'uplift' the standard of living of the society if applied properly and they reach the right target audience. But this highly important task of 'delivering' those messages have to be properly carried out by media only. Thus, it is obvious that a judicious selection of a media combine is the only answer to this question. In this unit, we shall discuss in detail about various media which can be used for communicating relevant messages at different points of time by the people concerned. The aim is to reach out to the people with some specific ideas for benefitting their lives.

7.3 PRINT MEDIA

Print is the oldest mass media of communication and it is still highly relevant for our specific purpose even today. This media embraces a wide range of individual entities like newspapers, magazines, books, pamphlets, monographs etc. These are used at different points of time by researchers, communicators to reach out to the targeted audience. In our country, according to the Registrar of Newspapers, Delhi, there are more than 1,00,000 registered titles disseminating news as well as other messages to the population on an average every passing day. This is apart from the lakhs of books published by different publishers in a year including textbooks of course.

There is no doubt that it is one of the most important media for communicating science messages to the people in a highly cost-effective and convenient manner as it is a cheap medium. There are advantages and disadvantages of this media. Such as ---

- As it needs to be delivered to the people at their doorsteps, it is time-consuming,
- For the same reason as above, it is difficult to repeatedly deliver the newspapers more than once in a day,
- For remote areas, it may take two to three days for delivering the newspaper to the people
- As it is a written media, many a times it is difficult to demonstrate not so simple ideas to the readers in a simple language
- While photographs speak a thousand words and thereby help a lot in making people understand a concept, yet a certain amount of limitation remains in this regard
- For these factors, readers my also interpret news items in their own ways which is not a desirable development or expectation from such a presentation
- Being a black and white media, many a times there is a problem of a section of the people not being able to access it because of lack of general literacy

7.3.1 Newspapers

A newspaper normally aims at catering to a large audience of lakhs of readers everyday making conscious efforts in trying to present news items on a wide variety of themes and areas. And science and technology (S&T) issues may be just one of them. Nowadays we have many newspapers including dailies or non-dailies which are published in a particular area of life such as sports, business etc., But launching a full newspaper just for science and technology news items may not seem viable at all for various reasons. However, it is a good sign that some of the newspapers, mainly dailies devote at least a full page or half page usually once a week for S&T or health-related issues. The Hindu is a good example which publishes a full page once a week dedicated to this field for the benefit of the readers and people concerned. Many others do give a coverage of science and technology or health-related happenings, events etc, in their papers. But these are usually about the event rather than the actual and relevant messages and facts and figures which should have been covered in reality. However, it is also a reality that coverage of S&T related issues is a very rare happening for a usual newspaper.

7.3.2 Magazines and Journals

Magazines

These are another class of the Print Media which are also highly relevant for our discussion. A magazine may be of monthly or fortnightly duration mostly covering general day-to-day issues of human society. But many of them may also be dedicated to a particular cause or area like fashion, cinema, sports etc. Yet, a few organizations or institutions also do publish magazines devoted wholly to our cause - science and technology issues.

For example, National Geographic is a relevant one and highly-revered in the circles concerned. From India, National Institute of Science Communication and Information Resources (NISCAIR), a CSIR institution under Government of India has been publishing

Science Reporter regularly for many years now. This magazine aims at informing the readers about various newer developments in this field in a simple language. It has been reasonably successful in its objectives over the years. Similarly, the Frontline (The Hindu Group of Publications) has been publishing recent S&T developments with simple language written by experts in each of its issues. Also, the popular Assamese general-purpose fortnightly magazine Prantik regularly carries two full page news items about latest developments in science and technology and one or two interesting anecdotes about famous scientists.

Journals :

These are periodical publications which are fully dedicated to S&T issues either in a general way or in a specific area out of it. A very prominent example is Nature which is a multidisciplinary journal in the field of science and reputed as one of the best in this field. Similarly, in the field of medical and health areas, there are - Lancet, the British Medical Journal etc. Also known as academic journals they operate in a specific way so that only the best and high quality research findings are actually published in them. Such as, a scientist or researcher arrives at a definite result after a long and rigorous process of research study. Then the person or the research team submits an article or research paper with necessary proof to the journal in a format of their own. Following this, there are several levels of high quality review or refereeing of the article. That is, in the first instance, the editor or senior editor of the journal would decide whether it is worth sending for further scrutiny or not. If found worth, it will be sent to established and reputed experts in that particular area of study for their comments and observations. Usually, it is sent to three experts from a panel. If these experts give a positive report then only the article or paper would be finally accepted for publication. This is a major recognition of the research team's efforts and subsequent success. But, here is a twist. That is - when the article shall be sent to the experts for review, it shall be forwarded in a manner in which the experts would not know who is the writer of

the paper so that no bias develops in the process. Also, most of the times, some or other serious counter observations come from the experts. It may be like - the findings are wholly rejected as not properly done, there may be major or minor revisions suggested before acceptance. Sometimes, after major review is suggested, the revised article is required to be submitted again for reviewing whether the corrections have been carried out properly or not. Many a times, it is common to see papers or articles being sent back for further revision more than twice also. This system is called 'blind peer review' as the experts really do not know who has written or prepared those articles to minimize any personal bias or favouritism.

A journal is a major way of authentication of research findings in different fields by various researchers. Only thing is that they are meant for circulation among the scientific or researchers' communities beyond which it may be quite difficult or impossible for general readers to understand the implications. That is why, the challenge is to write for popular magazines where complex findings or developments are expected to be delivered to the people in a language that they do understand in a proper way.

Again, there is this journal Indian Journal of Science Communication published by the Indian Science Communication Society, Lucknow. This has been a popular science journal for almost two decades now which is published four times a year. In Assam, Bijyan Jeuti is also an example of such a venture which has been in existence for about five decades now. It is published by Assam Science Society - a pioneer in this field.

7.3.3 Books

A book is another important media for science communication. It is a store house of knowledge in the form of articles, lessons, chapters etc. written by either one person or more on a particular topic or others. There can be more than two types of such books in circulation. For example, some of them may be published aimed at the scientific and researchers' community only. Others may be meant for understanding

by common persons for following the ideas given in them about our day-to-day life. Textbooks for various levels of academic programmes in this field can also be included here. A monograph is one such example of this media. Books are really a highly popular media for our purpose as it allows adequate space for discussing various concepts and ideas about science and technology.



LET US KNOW

- Media is a highly dynamic system.
- With the passage of time newer formats and combined forms of various media do evolve which become popular among the audience
- Each medium has its own characteristics which distinguish it from others
- Media is always a neutral system. We have to utilize it according to our goals and objectives
- While an Academic journal is for knowledgeable circles for that particular area of study, magazine and books are usually for the common people to have a basic understanding of a complex issue



CHECK YOUR PROGRESS

Q.1: Why is media so important in science communication ?

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Q.2: What are the major characteristics of Print Media ?

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Q.3: What is a 'blind peer review system' ?

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Q.4: What is a monograph ?

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7.4 AUDIO-VISUAL MEDIA

Like Print media, we can also sub categorize Audio-Visual media into a few segments. While these two types of media are powerful and effective on their own, yet a combination of both makes it far more impactful with a long lasting effect.

A few characteristics of this media are ---

- Unlike print, here the media need not be physically delivered. If a person possesses the required equipment like a Radio or TV set, one can access the contents either by paying a fees for the programme or mostly free of cost or at a very nominal cost.
- Programmes or contents can be played or broadcast repeatedly at any point of time whenever necessary
- As it can show a visual demonstration accompanied by the anchor or presenters' voice, it is much more effective in making people understand what is being sought to be communicated.
- Contents in the form of programmes or pure demonstration can be shown right from the place of happening like studios, laboratories, open fields where experiments might be carried out
- Contents once produced can be improvised whenever it may be necessary.

7.4.1 Radio

Radio is a highly popular media as it has been communicating with the people for a long time as a trusted supportive agent. Its most important advantage is that a person can be engaged in doing something even while listening to its contents. Soon after our country acquired Independence, there were hardly a few thousand newspapers with a low percentage of literacy among the people. And Television

was not even in the scene. So the newly-formed governments of the country deemed this media - Radio to be a very significantly- potential medium for this purpose. That is, disseminating meaningful messages to the masses at grassroots level across the length and breadth of the nation. And soon Green Revolution was launched which was a major success story. Then, radio - specially All India Radio (AIR) - the only convenient and cheaply available media was taken into confidence for publicising the messages. These media have proved its true worth at that period by carrying out its responsibilities in this regard to the fullest possible extent. That too with more than adequate satisfaction and success. In the process many of the seed varieties or processes of agriculture even came to be known as 'Radio Seeds'. Even later on, programmes on agricultural issues, health and hygiene etc. were the mainstay of this media. This has made it a highly reliable and effective medium for science communication which is still continuing today. It has a very rich legacy of contents in this field. Nowadays, community radio is another very helpful and convenient media for spreading messages of science for the people.

7.4.2 Television

This is one powerful medium for spreading science-related messages to the people of all categories.

As it can offer visuals its impact seems to be better than any other media. There are thousands of TV channels all over the world. Among these, quite a few like National Geographic, Planet Earth etc. are dedicated fully to science and technology aspects. Many other general TV channels also feature S&T-related programme. In our country, Doordarshan (DD) has long been broadcasting Krishi Darshan programme for the benefit of the farmers. Besides, in the 1990s, the great scientist philosopher (late) Prof. Yash Pal visualized a serial programme termed ‘Turning Point’ for DD. This programme had focussed on a particular science issue for each episode and went in-depth about its various aspects to enlighten the people about it. Some of the issues were anchored by popular actor Nasiruddin

Shah while Prof. Yash Pal also took part in a few of the episodes making it far more effective and impactful. Then, in the 2000s, a very successful programme on health issues named Kalyani was launched which went on for a long time providing benefits to lakhs of people. This programme, conceived centrally by DD was televised in regional languages of the states with their own programme formats while keeping the basic structure same.



LET US KNOW

- All India Radio covers almost 95 % of the country's geographical areas
- It possesses a rich legacy of various programmes on science and technology-related issues for the benefit of the audience
- It played a major role in dissemination of messages during the Green Revolution
- Krishi Darshan in Doordarshan has been continuing almost since its inception
- Turning point was an interesting and successful educational programme focussing on one specific issue of human life
- Kalyani was a highly popular health-based programme which benefitted lakhs of people across the country.



CHECK YOUR PROGRESS

Q.5: What are the advantages of an audio-visual media for disseminating science-related messages?

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Q.6: What role was played by AIR in Green Revolution ?

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Q.7: Mention a few specific science-related programmes that are highly popular and beneficial to the people on Doordarshan and AIR.

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7.5 FOLK MEDIA

Folk and traditional media of any society are usually very effective media entities. People identify with these performances and activities and thereby acquire messages from the contents used by the performers. Presently, it is the age of latest developments in mass media and new media. Mass media are also termed as conventional media. But the importance and relevance of folk and traditional media would remain intact forever without any doubt. As they are normally performed in close groups with a 'personal' appeal, they are much more effective in disseminating any intended message to the community. It may be mentioned that there are no specific creators identified with these performances and renderings. But from time-to-time every passing age, communities modify them to suit the real life situation of the current age and thereby keep them relevant for all ages and periods alike. For example, in Bihu and Ojapali performances of Assam, we can see reflections of the current day happenings in the songs and performances. In Manipur's Sumang Leela and Sumang Kumai, contemporary issues of society are highlighted in an effective manner so that the status of the society is reflected in a proper way.

So, if these performances can be utilized for spreading basic nuances of living a rational standard of life, it would be an ideal development.

Few characteristics of this media ---

- It is inclusive with participation of the audiences or the community
- As they are of the people, by the people and for the people, their importance in any society is always intact despite the aggressive existence of mass media and new media
- Being people-oriented without a rigid structure, performances and functions can be improvised and oriented with localised issues and contents as and when felt necessary

- The performances and the media get enriched by these improvisations which is a perennial process
- At one point of time, there was an apprehension that mass media and new media would cause a major disturbance to them. However, this turned out to be blessing in disguise rather. Because modern media also facilitated the worldwide spread of the folk and traditional media performances
- One disadvantage is that at one pint of time of performance it can communicate effectively to a limited number of people unlike mass media which caters to lakhs of audiences at the same time.

7.6 INTERACTIVE MEDIA

Being students of communication, you must already be conversant with a particular fact. That is, the communication process needs to be a 'dialogue' with participation of at least two or more sides in it to be more successful. of course, in case of intrapersonal communication, this does not apply. The media that we have discussed above are not interactive or participatory except folk and traditional media. Hence, the aspect of interactive nature is a major condition for success in the communication activity. It also makes it 'personal' unlike mass media. Nowadays, with advancement in technology, many of the media are going the 'interactive' way in different ways. For example, in internet platform-based-contents or programmes, a person can ask questions, or tap on a term or word to know more about it or get an explanation about it. If not instantly, at least at a sooner time the content provider shall get back to the inquisitive audience with more details about the aspect. The hyperlinks in many of the news items, blogs, articles, explanations etc. are a way of interactive nature of the contents. It is not that mass media was completely 'non-interactive'. For various programmes like songs on request, more specifically agriculture programmes and those like Kalyani (health programme) interactivity was visualized in different forms. In case of Kalyani, a specific theme of health problem was announced much before the programme was to be broadcast and publicity was made about it. On the day of the progrmme, usually two prominent and experienced medical practitioners would be invited who would discuss some basic ideas about it.

An anchor in the form of a simple person would carry over the discussions. and phone calls from interested persons would be received instantly for discussion on that person's particular medical problem with the doctors prescribing solutions to the possible extent. Or asking the person concerned to consult a relevant expert in this regard. For Turning Point, peoples' opinions and problems were requested to be forwarded for possible discussion and focusing at an opportune time. Science museums also can be dubbed as interactive media to a big extent as majority of them have provisions for display of science-related machineries and experiments which are 'do-it-yourself' kind of activities and exercises.

Interactivity helps us in several ways. More so for S&T-related matters. Such as -

- It helps us in getting a better idea or review of what is already being disseminated
- Helps us in clarifying our doubts, confusions, hesitations
- In case of health-related issues, the identity of the caller or audience need not be revealed
- This also enhances the enthusiasm of the audiences as one enjoys or feels the excitement of participation and identifies oneself with it.

7.7 MEDIA ON WHEELS

This is one media that we should know about as it is highly effective, interesting and convenient specially for the young generation audience. Being an unusual one from the regular media as described above, so we should know about it. This unique concept is called Science Express Climate Action Special (SECAS) launched in 2007 by Department of Science and Technology, Government of India This has been an interesting 'mobile science and technology' exhibition mounted on a full train from Indian Railways. And most of the coaches of it are fitted with various machines, laboratories, posters, book stall etc. There was a group of volunteers who were experts in different fields of S&T dedicated to serving as guides to enthusiastic people. More so for children who would be visiting the train at designated places. There have been a total of seven phases of this

endeavour and one of the trains visited Assam and stayed at Rangapara station near Tezpur town apart from a few other places in the state a few years ago. This author had an opportunity to visit this train and was highly impressed by the wide range of subjects and aspects presented in it. Thousands of school children and adults visited it and were benefitted by it.

"This unique mobile exhibition was first launched in October 2007 by DST. It has since then made eight tours of the country, travelling about 142,000 km and exhibiting at 455 locations. Over its 1602 exhibition days, Science Express received an overwhelming response from 1.56 crore visitors. It has become the largest, the longest running and the most visited mobile science exhibition. Science Express Phases I to IV showcased cutting-edge research in Science and Technology being carried out worldwide. Phase V to VII were based on the theme of biodiversity and known as 'Science Express Biodiversity Special (SEBS)'. It showcased the rich biodiversity of India and its conservation measures. Phase VIII as was designed as 'Science Express Climate Action Special (SECAS)' which was initiated highlight the global challenge of climate change and effective mitigation measures." (http://www.wiienvis.nic.in › SECAS_2017_8567)

Also, in addition to the contents on the train, the volunteers organized quizzes, innovative ideas contests etc. among the visiting students' groups which made it a unique lifetime learning opportunity for the participants. This kind of innovative media should be encouraged more in future by the authorities concerned in this direction.



CHECK YOUR PROGRESS

Q.8: What is the utility of folk media in science communication ?

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Q.9: Can we term folk media as interactive media ? How ?

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Q.10: How does folk media enhance its acceptance in society ?

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Q.11: Why is interactivity more effective in impacting people ?

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Q.12: What is the concept of Science Communication on wheels as demonstrated by SECAM ?

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7.8 FEW OBSERVATIONS

Though we have discussed about a few media here, the scope is not limited to only these ones. Media is a dynamic and flexible entity and it always evolves with new systems or format in every age and time period. It is to be noted that one particular media may not be completely convenient for a specific purpose. Thus, we may have to combine more than one of them for achieving our purpose in a proper manner. Further, every media has its own characteristics. This aspect allows us to know which one would be better for a specific issue and society under any given circumstance. Media planning is an important concept as mentioned at the outset which needs to be mastered properly if science communication has to be successful. Also, proper and adequate identification of the target audience, its profile, designing of messages based on these aspects etc. are equally important to make the programme a success.



7.9 LET US SUM UP

- Folk media is more participation-oriented and attached with the immediate community of which it is a part of

- Normally there is no known creators or writers of the folk renderings and performances and people contribute to it in every passing age by adding to the experiences
- It is very dynamic as it keeps up with changing times and the upcoming issues or the society in every age
- Over the years, the arts get improvised with localized contents and performances
- The fear that mass media would spell doom for it has gone away as it is actually facilitated by the latter It is considered as a 'personal' medium rather than being an 'impersonal' one like mass media
- Interactive media is more lively as it allows participation from audiences
- Though interactivity is more prominent in internet-based media, even the the other forms of mass media have this characteristic.
- SECAM has been a unique experiment on science communication on wheels concept and a highly successful one



7.10 FURTHER READING

1. Social media science communication is a nonstop academic conference for all retrieved from https://www.nature.com/articles/s41562-021-01138-0
2. Audio-visual Science Communication on TV and YouTube. How Recipients Understand and Evaluate Science Videos retrieved from https://www.frontiersin.org/articles/10.3389/fcomm.2020.608620/full
3. The communication of scientific research in news media: Contemporary challenges and opportunities Comment retrieved from https://jcom.sissa.it/archive/19/03/JCOM_1903_2020_C01/JCOM_1903_2020_C06
5. Science communication media for scientists and the public retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2002562/
6. Gap between science and media revisited: Scientists as public communicators retrieved from https://www.pnas.org/doi/10.1073/pnas.1212745110



7.11 ANSWERS TO CHECK YOUR PROGRESS

Ans. to Q. No. 1: Because it is the media which can only help us in reaching out to the targeted audience with our messages. This is because there may be interesting research findings which may have huge potential for enhancing the standard of living of human beings. But, if these findings can't be acquired by people they would not be able to utilize them and that would be a waste. Here, media can play a decisive role in disseminating those contents to the masses.

Ans. to Q. No. 2: As Print media has to be delivered physically it is time-consuming and difficult to repeatedly deliver the newspapers more than once in a day. This may lead to delay of more than one day in delivering it in remote areas. Being printed media, it may be difficult to express some concepts in a clear manner leading the readers to interpret in their own ways which is not a desirable prospect. One needs to be literate to go through it.

Ans. to Q. No. 3: This is a concept used in academic research journals where all submitted articles to the journal are sent for rigorous reviews (evaluation) by subject experts. That is, if the editor of the journal at first finds that it is worth sending for review. It is called blind peer review because it is communicated to the experts in such a way that they do not identity the writers or scientists of that article. If only the experts approve of the article, it is published after revising the same if needed.

Ans. to Q. No. 4: It is like a book only but written on a particular theme or subject in a highly-specialized way with adequate research studies dedicated for the purpose. It is usually written by a single person or a research group.

Ans. to Q. No. 5: Audio-visual media can show a live demonstration of any experiment, exercise or activity which makes it much more convenient to understand. Also, the contents can be stored for future viewing whenever needed. Besides, the audio-visual effect makes

messages much more impactful compared to other media.

Ans. to Q. No. 6: In absence of any other prominent media like TV and very low presence of print media, AIR was instrumental in spreading messages of Green Revolution. Even many of the agricultural innovative systems and seeds used to be known as Radio Seeds because of this effort of All India Radio (AIR).

Ans. to Q. No. 7: A few vey successful and popular science and health-related programmes in Doordarshan are - Krishi Darshan, Turning Point and Kalyani (health programme). The first one is dedicated to agriculture-related issues. The second one dealt with one particular problem of science with experts delivering in-depth analysis and knowledge for benefit of audience. The third one has been a health-based programme in which medical experts would discuss the issue with online consultation with interested persons over telephone calls. AIR also had somewhat similar programmes primarily in agriculture,health and hygiene-related matters.

Ans. to Q. No. 8: Folk media by virtue of its being interactive and participatory is still relevant for disseminating science-related matters and shall remain so forever. As it allows real time participation, people feel themselves a part of it thereby its messages are more effective and carries a lot of impact.

Ans. to Q. No. 9: Yes. It is much more interactive than any other media. It is performed among the people or communities. So, any member of the latter can participate inspired by its performances. This aspect enhances the sense of belonginess for the audience and the impact is more than any other media.

Ans. to Q. No. 10: Being highly inclusive and participatory with simple ways of functioning, it endears itself to the people and thereby raise its acceptance in society. That sense of belongingness is so important in this regard.

Ans. to Q. No. 11: Because a person accepts a message by wholeheartedly participating in the performances which makes one sensitized towards a particular issue. The same opportunity is almost non existence in case of mass media as this is primarily an

'impersonal' media with much-delayed responsiveness or feedback registering system.

Ans. to Q. No. 12: It has been a fully-dedicated science-theme-based train that travelled around the country for popularizing science-related concepts particularly for children but also to others interested. Promoted by Department of Science and Technology, Government of India, its seven phases focussed on different areas of science and technology based on real life issues. It has been a highly popular experiment that should be repeated again in future.



7.12 MODEL QUESTIONS

A. Short Questions (Answer each question in about 150 words)

Q. 1: Discuss the necessity of media for science communication.

Q. 2: What is media planning ? Describe various media for science communication along with their advantages and disadvantages.

Q. 3: Why is it believed that folk media is more effective and impactful than other media ?

B. Long Questions (Answer each question in about 300-500 words)

Q. 1: What is your understanding of the concept of Interactivity ? How can a media be interactive ?

Q. 2: How can mass media and folk media play a complementary role with each other ?

Q. 3: Is there any scope for using media in a flexible and participatory manner for science communication ?

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UNIT 8: SCIENCE POPULARIZATION PROGRAMMES

UNIT STRUCTURE

8.1 Learning Objectives

8.2 Introduction

8.3 Science Popularization

- 8.3.1 Programmes
- 8.3.2 Organizations
- 8.3.3 Individuals

8.4 Methods of Science popularization

8.5 Scientific Temperament

8.6 Role of various institutions

- 8.6.1 CDAC
- 8.6.2 NCSTC
- 8.6.3 Vigyan Prasar

8.7 Let Us Sum Up

8.8 Further Reading

8.9 Answers to Check Your Progress

8.10 Model Questions

8.1 LEARNING OBJECTIVES

A thorough and comprehensive reading of this unit shall enable you to understand -

- the various types of science popularization programmes
- the different organizations undertaking this exercise
- the benefits of these activities
- how the concepts of science and technological developments can be taken to the people through these programmes
- what possible innovations can be applied for achieving this objective.

8.2 INTRODUCTION

'The popularization of science and technology is intended to provide broad sectors of the population with the challenge and satisfaction of understanding the universe in which we live and, above all, being able to imagine and build possible new worlds'. Eduardo Martinez (Regional Specialist, Science and Technology Management, UNESCO office, Uruguay)

It is often observed that whenever Science and Technology (S&T), specially the first one is mentioned, majority of the people view it as something very difficult and complex. More so for children in schools. However, it should be kept in mind that the various research findings of S&T have been able to arrive at a highly satisfactory state. These findings, if applied to our day-to-day individual and social life, have the potential to make our lives far more comfortable, safe, hygienic and rational etc. Thus, in addition to having plenty of such innovations, research findings at our laboratories and institutions, it is equally important enough to disseminate the same to the people. That is, to ensure that the latter can adopt them and improvise their standard of living in the coming days. Besides, there is this added responsibility of gradually and steadily inculcating a 'scientific temperament' among the people at all levels of the society. In this regard we can recall the motto of All India Radio here - Bahujana hitaya, bahujana Sukhaya. It means 'dedicated to the welfare and peace of the majority of the people of society.' If the modern developments of S&T can't be properly utilized for the empowerment and enhancing a better living standard for the masses, it does not have much value in the overall sense. Thus, science popularization programmes are the need of the hour. Several institutions of the government and non-government sectors along with visionary individuals have thought of and launched such exercises over the decades to achieve the objectives in the right earnest. We need to study them for improvising them to suit the changing needs of the society of the future. And also look for gaps in this direction so that things can be improved with adequate expertise.

8.3 SCIENCE POPULARIZATION

At the very beginning a question might arise in your minds - why does science need to be popularized at all. Scientific findings and principles need to be popularized for allowing to know about them so that the people can be empowered after knowing the explanations about various phenomena of the world. For example, whenever there is full or partial solar or lunar eclipse, we can see many conversations. These include those that one should not look at the sun or moon with naked eyes and observe fast for that period and if possible remain indoors. This has been witnessed by this author since his childhood. However, scientific fact finding has proved that there is no truth in these advises. A few years back, a group of scientists and rational-minded persons in our country have even hired an aeroplane and travelled by air to take a closer look at the sun to prove their point. And there was no difficulty in doing so without any problem to the contrary. Also, there was a major need for educating people about the various precautions needed to be adopted during the COVID19 pandemic period. So because we could see that a good number of people did not adhere to them in a proper manner. Even in case of very basic activities of life like open defecation, dumping of garbage in an unscientific way, not leaving space for proper drainage and sewage treatment facilities etc. so many issues people need to be inculcated with scientific principles. Many of you may have heard about the village of Meghalaya declared as 'the cleanest one in Asia'. Residents of this village take pride in this achievement and have vowed to maintain this status forever. Now, indirectly this is also a popularization programme on hygienic living. So why not we try to inspire more and more people to adopt such an attitude and start developing at least their immediate neighbourhood for such an endeavour. A reluctance may be experienced in a lot of the people in the society in adopting these principles for improving the society's standard of living. That is why we can go with the concept of 'catch them young' by targeting the schoolchildren and also those in higher education bracket as the change agents for this effort.

An article titled 'Boosting public understanding of science and technology in developing countries' was published in Nature. Here the author says that activities aimed at the popularization of science and technology pointed in various directions, from the 'distribution' of information in the mass media to formal education, and from the democratizing function of science and technology interactive centres to the creation of diverse spaces or processes for non-formal participation. All of them try to broaden the public mind that can be linked actively in the discovery, understanding and appropriation of scientific and technological knowledge. And these activities must be based on interdisciplinary dialogue and work, integrating diverse fields of knowledge and different theoretical and methodological approaches.

It is similar to a pyramid which rests on four components:

- Science and technology interactive centres;
- Multimedia programmes for science and technology popularization;
- Mass media and the dissemination of science and technology; and
- Formal education/science learning.

8.3.1 Programmes

Different kinds of programmes for popularizing science have been undertaken at various levels of institutions and organizations both under the government and non-government sectors.

- Observation of National Science Day for commemorating the discovery of Raman

  Effect is one very prominent example. It is observed every year with a specific theme to focus upon by universities and institutions. They undertake various programmes like popular lectures, visit to laboratories and research facilities, nature walks, hands on workshops with prominent researchers from S&T sector among others. It has been organized since 1986 on the recommendation of NCSTC to the Government of India.

- National Children's Science Congress observed at national level preceded by state-

  level competitions to inculcate S&T ideas is another important programme. The objective is to make them familiar with these ideas and principles. We shall discuss bout it in details later.

- An ambitious and popular programme titled 'Kishore Vaigyanik Protsahan Yojana'

  (KVPY) was introduced in 1999 by the Department of Science and Technology (DST), Government of India which proved to be highly successful. In the words of the programme's website, "the aim of the programme has been to encourage students who are studying Basic Sciences to take up research career in Science."

- Then there is also the Vigyan Prasar Science NETwork of Science Clubs or VIPNET

  It was launched in 1988 for "providing a fillip to the science clubs movement in India" so that schoolchildren could be encouraged for developing an interest in science-related matters.

- Here is the regional science museums under the National Council of Science

  Museums based at Kolkata with a network of 25 such centres across the country including Guwahati. The primary objective of these museums is to attract schoolchildren and also others interested for experiencing various basic ideas of science and technology in a 'do it yourself' manner. The exercise is expected to enhance the learning capacity of the visitors to realize the basic underlying principles of various phenomena in this field.

- The National Council of Science and Technology Communication (NCSTC) under

DST, GoI, has another programme titled National Teachers' Science Congress in addition to its major initiative of National Children's Science Congress (NCSC).

- Publication of science journals usually in popular article mode is one important way of making an effort to popularize science among various levels of population. Binjan Jeuti of Assam Science Society and several other such associations or societies are examples of efforts in popularizing science among people.

8.3.2 Organizations

The UNESCO declares that by bridging the gap between science and society the benefits of scientific knowledge can be used to improve daily lives, empower people and find solutions to global, regional and local challenges. Hence, to strengthen communication between science and society it is important that efforts made in bridging the gap do not go unnoticed. Popularizing science needs to be championed, including all activities that communicate scientific knowledge and methods to the public outside the formal classroom setting and promote public understanding of the history of science. Hence, it has decided to institute the UNESCO Kalinga Prize for Popularization of Science. It is a global award to recognize as well as accord incentive to persons for exceptional contributions in communicating science to society and promoting the popularization of science. (UNESCO Wbsite).

“It is awarded to persons who have had a distinguished career as writer, editor, lecturer, radio, television, or web programme director, or film producer in helping interpret science, research and technology to the public. UNESCO Kalinga Prize winners know the potential power of science, technology, and research in improving public welfare, enriching the cultural heritage of nations and providing solutions to societal problems on the local, regional and global level,” UNESCO website.

Apart from this international organization, there are quite a few organizations actively engaged in various activities in this field for the benefit of mankind. These include science societies, various media establishments, those under government patronage like CSIR-NISCAIR, NCSTC, VP, ISRO among others. You should go through the websites of these institutions for detailed activities. We shall also discuss a few aspects of some of these institutions in the later part of this unit for your advantage.

Museums of all kinds including the National Museum (Delhi), Indira Gandhi Rashtriya Manab Sangrahalaya (Bhopal), those under the NCSM, planetariums are other types of organisational efforts in science popularization.

8.3.3 Individuals

In addition to institutions, organizations, there have been quite a few scientists, researchers, innovators over the centuries and decades who have contributed towards this direction in their own ways. There are examples of writing of scientific books in the West as well as Indian context. Charak Samhita and Shushruta Samhita. books can be termed as earlier efforts in popularizing various aspects of science at a period when this was an unheard of concept. In the modern times, we can cite the name of JV Narlikar who did pioneering works in this field. The uniqueness of these communicators lies in the fact that they could interact with the targeted audience in a language which was easily understandable to the latter without any problem thereby helping them thereby helping them understand what was being tried to be disseminated. In the Assamese context there are several such personalities - scientists and researchers who have been able to communicate effectively with the audience in simple and understandable language over the decades. They include Dr Dinesh Chandra Goswami, Dr Kshiradhar Barua as the leading ones. Some of the communicators like Jules Verne, Issac Asimov among others use the science fiction mode of communication for sending across an

idea to the people for ease of understanding. Apart from books, popular articles, science fiction novels, many feature films like The Martian facilitate peoples' understanding in a simple way. At least one can get a rough idea about the whole activity.

It needs to be mentioned that organizations, institutions and individual researchers and scientists must come together to continue this effort in various ways and means. A synergistic relationship must be developed among these stakeholders to carry this effort towards fulfilment for the benefit of all concerned.

It is worth mentioning here that several universities and institutions have also been conducting formal academic programmes in science communication and popularization. The idea is to develop an adequate number of future science communicators who can be groomed for taking up this challenge. The government and all research and teaching institutions engaged in the field of S&T activities have been trying their best to strongly encourage the resource persons to make continuous efforts in communicating their findings for the overall advantage of the society.

8.4 METHODS OF SCIENCE POPULARIZATION

We have discussed a few ways of popularizing science among various age groups of people. In addition to these initiatives, films and documentaries, science theme parks etc. are also other means of popularizing science. The basic objective of these exercises is to reach out to maximum number of schoolchildren and other people so that scientific ideas and mentality can be inculcated among them. In case of NCSC, at the first level schoolchildren from districts are involved in preparing and showcasing science-issue based models and methods. And those judged as the best ones are sent for state-level to be followed by national-level contest. It is done for developing a positively-competitive mindset for developing S&T-related products and systems. In the process, the schoolchildren become aware of the benefits of the need for developing a scientific mindset. Those students who are declared successful in KVPY competition which is a tough one to compete are awarded

scholarships for pursuing higher studies in science and technology. Further, such achievements in KVPY was also considered as a way of getting admission in higher degree programmes in various institutions offering S&T academic programmes.

Over the last few years, the government has come up with a new idea in this regard. It is that all institutions and academic organizations working in the field of S&T development should showcase their research findings to the public. The primary objective is that people can become aware of the latest developments in these fields and thereby can think of adopting some of these innovations or inventions in their life. Thus, all these organizations including those in Defence sector dedicate specific days and times of the year for public display of their developments. It is expected that mass people can get to know about them and apply the same in their own life.

Similarly, in agriculture universities including colleges of Veterinary sciences, there is the provision of Extension Education Centres. The major mandate of these centres is to expand or communicate to the masses the advancements in technologies for adoption by the people.

The underlying idea behind these exercises is to implement the 'lab to field' concept of transferring the benefits of S&T to the masses wherever and whichever way they might be relevant to the real needs of the people in society.

Bharat Jan Vigyan Jatha (BJVJ) : A unique experience

While discussing science popularization programmes and initiatives, it would not be complete without some words on this unusual and novel experiment. Conceived by Kerala Shastra Sahitya Parishad (KSSP), a voluntary body dedicated to the spread of a scientific temper its aim was to popularize the cause of science. According to a news report in The Times of India (15, 1987, updated on Dec. 13, 2013), the show was designed in every possible way to excite curiosity among ordinary people about science. The first sign of the unusual event is a pilot van with a four-man crew of aeromodellers and ham-radio operators who stage a special aerobatics show". Launched on Oct 2, it was expected to be concluded on Nov. 7, birth day of Sir CV Raman.

It is highly encouraging to think that the organization led by farsighted leaders could visualize such a unique experiment way back about three-and-a-half decades ago. It traversed the entire country demonstrating simple experiments and aspects of science to the people, specially those of younger generations. It may be mentioned here that this author who was in his higher class of school also witnessed this activity in a remote town of Assam.

8.5 SCIENTIFIC TEMPERAMENT

This is a highly important aspect of the whole activity of science communication. It means inculcation of a mindset which is rational enough not to accept anything without a logical or scientific analysis. For example, a person may be advised to use a particular type of 'gem' or ring made of a specific metal for getting rid of so called 'bad days' in his or her life. This happens quite a lot in the society. Now, if the person who is advised like this is a rational thinker, one would never go for such advises. Similarly, when people were asked to wear masks in the times of COVID19 pandemic those who were rational-minded used this as a preventive measure against the disease. But in case of many others we could see that they refused to wear masks with various excuses despite repeated advises from medical practitioners to do that. Again, maintaining of social distance, defecating in the open, spitting and smoking in public places, throwing garbage anywhere are also ready examples of people not having a logical and rational mindset or a scientific temperament. The excuses for not doing so are mostly baseless and does not stand scientific scrutiny. Another small example is the feeding and teasing of animals in zoos which should not be done at all. However, visitors end up most often doing so despite countless reminders about it.

Following our Independence, the governments have put a huge amount of emphasis upon disseminating advisories about living a better standard of life by adopting modern and scientific methods of doing things. Hence, institutional delivery of babies or birth of new-born babies in a health facility were advised. That would be helpful as experienced properly-

trained medical personnel would assist here rather than giving birth at home without that. It was encouraged to a big extent and at present a significant success have been achieved in this direction. Further, administering of vaccines for various problems including Pulse Polio, use of iodised salt etc. also needed a strong scientific mindset to be developed so that these ideas were adopted by the people for the sake of a healthy society.

This is an ongoing effort and must be supported by all sections of society including government, non-government institutions for converting it into a success in the coming days. Though obviously a difficult task, yet it is not unachievable.

8.6 ROLE OF VARIOUS INSTITUTIONS

To sustain the effort of popularizing as well as utilizing the advances in the S&T field, the government has at various points of time established institutions with specific goals to be achieved. These organizations and institutions ranges from the Indian Institutes of Technology (IIT), Centre for Development of Advanced Computing (C-DAC), Indian Council of Agricultural Research (ICAR) Vigyan Prasar, National Council of Science and Technology Communication (NCSTC), National Children's Science Congress, Council of Scientific and Industrial Research (CSIR) and National Institute of Scientific Communication and Information Resources (NISCAIR), National Laboratories in Physics, Chemistry, Indian Institute Science Education and Research (IISER) among others. They are primarily being engaged in research and innovation in different areas of S&T. Yet, these organizations are also doing their best for popularizing S&T-related aspects and concepts for the benefit of the common people. The idea is to help the masses so that they can enhance the standard of living of their life by the findings from these institutions.

8.6.1 C-DAC

Established in 1988 under the Ministry of Electronics and Information Technology (MeitY) for carrying out Research &

Development (R&D) in IT, Electronics and associated areas, it has been carrying out pioneering and high-value research and extension activities in their mandated field. These include building of PARAM series of supercomputers, Indian Language Computing Solutions by setting up GIST group (Graphics and Intelligence-based Script Technology) and also Indian Language Computing around the same period. Health informatics programmes are also one of its major priority areas which facilitates maintenance, exchange of information in the health sector to a big extent. Since 1994 it has also been involved rigorously in education and training of Industry professionals on specific requirement for raising the expertise of intending industrial organizations.

"As an institution for high-end R&D, C-DAC has been at the forefront of the Information Technology (IT) revolution, constantly building capacities in emerging / enabling technologies. And also innovating and leveraging its expertise, caliber, skill sets to develop and deploy IT products and solutions for different sectors of the economy, as per the mandate of its parent, the MeitY, Government of India and other stakeholders including funding agencies, collaborators, users and the market-place," – C-DAC website.

8.6.2 NCSTC

This agency was set up specifically for communicating Science and Technology to masses, stimulate scientific and technological temper, coordinate and orchestrate such efforts throughout the country. Upliftment of the society through dissemination of scientific knowledge to the people and subsequent adoption of the same has been its primary goal. Since inception, it has been trying its best to achieve this objectives through various ways and means with a major amount of success till date. A few of the schemes it has adopted over the years are —

Annual awards in the fields of - Outstanding Efforts in Science & Technology Communication through books and magazines,

among children, translation of popular S&T literature, print and electronic medium. It may be mentioned here that at least two prominent science communicators from Assam have received this award in the past about a decade.

It further organizes outreach activities, training in Science and Technology communication, development, production & dissemination of S & T software, incentive programmes, and field-based Sci-Com projects, research in S&T communication, international co-operation, motivating students and teachers, environmental awareness and programmes with a special component exclusively for women (NCSTC website).

Other popularization programmes of this organization include - campaigns over the Year of Scientific Awareness, Year of Physics, Year of Astronomy, Year of Mathematics, observation of the National Science Day and National Mathematics Day, the National Children's Science Congress, National Teacher's Science Congress, and Science Express etc. (NCSTC website).

NCSTC has been organising National Children's Science Congress since 1993 every year for "brilliant young scientists (10 - 17 years of age group) to popularize the method of science." This is done by working in teams under a guide on an identified problem from the neighbourhood, develop a hypothesis and conduct field researches patterns in data and prepare a report and present findings before peer group in one's own language The idea is to prepare future scientists of the country.

Simultaneously it also organizes the National Teachers' Science Congress (NTSC) for providing a platform to the country's teachers for upliftment the level of their scientific awareness since 2003 which is currently a biannual event. Additionally, it further engages teachers, educators of vocational / open schools / teachers educators / DIET faculty / B.Ed and university researchers,

scientists, technologists and activists to submit their papers. (Website).

8.6.3 Vigyan Prasar

Vigyan Prasar (VP) is an autonomous organization under the Department of Science and Technology (DST), Government of India. Its major objective is to serve India's science popularization agenda. It partners with various organizations and agencies or stakeholders to communicate about principles and practice of science and technology and implications for development of quality of life. Science popularization, therefore serves as a robust knowledge-led tool to fulfil three mutually reinforcing public policy objectives.

One of the primary goals is to create and foster a well-informed citizenry with special emphasis on developments in science and technology and the open-endedness and continual evolution of science and related knowledge systems. (Website).

Secondly, building capacities to communicate through inroads into formal and non – formal teaching and learning systems including education and other community-centred interventions across thrust areas and regions of the country. (website).

A third one is implicit in the first two as mentioned above here. It is about engagement that follows knowledge enrichment. (Website).

A major project of VP is the Science and Technology Communication, Popularization and Extension (SCoPE) in Indian languages. The Assamese language programme is being coordinated by the Mass Communication & Journalism Department of Tezpur university since 2021. The idea is to reach out to the different language speakers of the country to the maximum possible extent through various efforts involving different media including, Print, Audio-visual, interactive etc.



CHECK YOUR PROGRESS

Q.1: What is the importance of science popularization in today's world?

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Q.2: What type of programme can be taken up for reaching out to the masses ?

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Q.3: Is there any specific format for such programmes to be conducted ? What are those formats if there happens to be one?

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Q.4: Discuss a few organizations / institutions engaged in science popularization in India.

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Q.5: Write a few lines about the science popularization programmes the organisations these organizations take up from time-to-time.

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Q.6: What is your understanding of the term 'Scientific Temperament'?

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8.7 LET US SUM UP

- The various findings of research and advancements of science and related areas need to be popularized among the people, specially children and the young people so that they can adopt the best practices of these developments
- These programmes can take any form including a film, open access to laboratories on particular days to get oneself familiarized with recent innovations in these fields, demonstration of some aspects of science which may look like magical in nature.
- There are many organizations / institutions / agencies involved in popularizing science and related aspects in the world
- At different points of time, many of these institutions collaborate and set up a network of their activities for popularizing science-related activities which otherwise may have remained a mystery to the society
- Additionally, there are quite a few prominent and dedicated individuals, scientists, researchers who have contributed more than adequately to enrich peoples' understanding of science and associated aspects in the society. These persons have taken science popularization and communication as a major goal of their life
- Various methods are utilized for achieving success in this direction. These may differ from institution to institution and also person to person depending upon different circumstances.



8.8 FURTHER READING

Important websites -

1. Kerala State Council for Science, Technology and Environment (KSTEC), https://kscste.kerala.gov.in/
2. Institute of Fundamental Technological Research, Polish Academy of Sciences, https://www.ippt.pan.pl/en/scientific-activities/popularizing-science
3. Website of Vigyan Prasar / NCSTC / CSIR-NISCAIR / ASTEC,
4. Science Outreach & Popularisation, https://www.indiascienceandtechnology.gov.in/covid-19-the-pandemic/awareness-material/science-outreach-popularisation
5. Boosting public understanding of science and technology in developing countries, https://www.nature.com/wcs/c16.html



8.9 ANSWERS TO CHECK YOUR PROGRESS

Ans. to Q. No. 1: If the various developments in S&T are kept confined to the laboratories only, they will not be able to facilitate a better living standard for the people in the society. Thus they will be a waste only. So those findings which are directly beneficial for enhancing our state of life need to be popularized for human utilization in different walks of life.

Ans. to Q. No. 2: These programmes can be of various types like cinema, documentary on specific topics, visits to science laboratories, nature walks in the wildlife for introducing people to the rich aspects of

flora and fauna, conducting of exercises of science in simple forms as do-it-yourself activities etc. It depends to a big extent on the innovative mindset of a researcher or scientists about how interestingly these can be demonstrated.

Ans. to Q. No. 3: There are some methods being followed by scientists and researchers which have become popular over the ages as mentioned above. However, with the passage of time, ever new methods and systems of doing these exercises can be developed to attract the interests of the people and specially children.

Ans. to Q. No. 4: These institutions include C-DAC, NCSTC, VP, CSIR-NISCAIR, Indian Association for Cultivation of Science, various state-level science associations etc. Apart from their research activities which are also highly important, they are also engaged in carrying out popularization activities for passing on the benefits of S&T to the people at all levels of the society. Thus, the masses benefit properly from such endeavours.

Ans. to Q. No. 5: National Children's Science Congress (NCSC), National Teachers' Science Congress, publication of books, pamphlets, audio-visual programmes (both short and long) on different aspects of the field, laboratory visits, nature walks, popular lectures and talks with senior scientists, mobile exhibition vans etc. are just a few of the popularization programmes taken up by the persons and institutions concerned. There can be many other such innovative programmes which need not necessarily be similar to the already-existing ones. There is no limitation to utilizing different forms and innovative ideas in this regard. Only condition is that they should be attractive as well as effective.

Ans. to Q. No. 6: A Scientific Temperament simply means a rational or logical mindset who would not accept anything at face value and would accept it only after a proper analysis of the various facts and backgrounds. For example, a person may be asked not to look at the sun or moon during an eclipse times saying that it would badly affect his or her eyes. But the latter would study all relevant literature about it and consult knowledgeable persons before actually taking a decision in this regard. In simple terms it is the mindset which would analyse everything in a rational manner before taking a decision about experimenting with it at all. This is one of the topmost objectives of the whole exercise of science communication.



8.10 MODEL QUESTIONS

A. Short Questions (Answer each question in about 150 words)

Q. 1: What is the need for popularizing science and its related aspects among the people ?

Q. 2: Discuss the role played by organizations or institutions and also individual communicators, researchers or scientists in the field of popularization of science.

Q. 3: Write about various popular formats and methods of science popularization activities.

B. Long Questions (Answer each question in about 300-500 words)

Q. 1: What is the significance of inculcating a 'scientific temperament' among the people of the society ? How will the society benefit out of it in the long run ?

Q. 2: Discuss the contributions of a few scientists or science communicators over the years.

Q. 3: Compare the role played by the government and non-government sectors in science popularization in our country.

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