3 J C BOSE

- *Aldous Huxley*

Talking about the text

- Are you interested in doing scientific experiments?
- Who are your favourite Indian scientists?
- Do you feel that plants have life?
- Do plants also feel pain as human beings when they are cut?

Read the essay to find out.....

The experimenter's is a curious and special talent. Armed with a tea canister and some wire, with silk, a little sealing wax, and two or three jam – pots, Faraday marched forth against the mysterious powers of electricity. He returned in triumph with their captured secrets. It was just a question of suitably juxtaposing the wax, the glass jars, and the wires. The mysterious powers couldn't help surrendering. So simple – if you happened to be Faraday.

And if you happened to be Sir J C Bose it would be so simple, with a little clockwork, some needles and filaments, to devise machines that would make visible the growth of plants, the pulse of their vegetable 'hearts', the twitching of their nerves, the processes of their digestion. It would be so simple – though it cost even Bose long years of labour to perfect his instruments.

At the Bose Institute in Calcutta, the great experimenter himself was our guide. Through all an afternoon we followed him from marvel to marvel. Ardently and with an enthusiasm, with a copiousness of ideas that were almost too much for his powers of expression and left him impatiently stammering with the effort to elucidate methods, appraise results, unfold implications, he expounded them one by one. We watched the growth of a plant being traced out automatically by a needle on a sheet of smoked glass; we saw its sudden, shuddering reaction to an electric shock. We watched a plant feeding; in the process it was exhaling minute quantities of oxygen. Each time the accumulation of exhaled oxygen reached a certain amount, a little bell, like the bell that warns you when you are nearly at the end of your line of typewriting, automatically rang. When the sun shone on the plant, the bell rang often and regularly. Shaded, the plant stopped feeding; the bell rang only at long intervals, or not at all. A drop of stimulant added to the water in which the plant was standing set the bell wildly tinkling, as though some record breaking typist were at the machine. Near it – for the plant was feeding out of doors – stood a large tree. Sir J. C. Bose told us that it had been brought to the garden from a distance.

Transplanting is generally fatal to a full grown tree; it dies of shock. So would most men if their arms and legs were amputated without an anesthetic. Bose administered chloroform. The operation was completely successful. Walking the anaesthetized tree immediately took root in its new place and flourished.

But an overdose of chloroform is as fatal to a plant as to a man. In one of the laboratories we were shown the instrument which records the beating of a plant's 'heart'. By a system of levers, similar in principle to that with which the self – recording barometer has made us familiar, but enormously more delicate and sensitive, the minute pulsations, which occur in the layer of tissue immediately beneath the outer rind of the stem, are magnified – literally millions of times – and recorded automatically in a dotted graph on a moving sheet of smoked glass. Bose's instruments have made visible things that it has been hitherto impossible to see, even with the aid of the most powerful microscope. The normal vegetable ' heart beat', as we saw it recording itself point by point on the moving plate, is very slow. It must take the best part of a minute for the pulsating tissue to pass from maximum contraction to maximum expansion. But a grain of caffeine or of camphor affects the plant's 'heart' in exactly the same way as it affects the heart of an animal. The stimulant was added to the plant's water, and almost immediately the undulations of the graph lengthened out under our eyes and, at the same time, came closer together; the pulse of the plant's 'heart' had become more violent and more rapid. After the pick – me – up we administered poison. A mortal dose of chloroform was dropped into the water. The graph became the record of a death agony. As the poison paralyzed the 'heart', the ups and downs of the graph flattened out into a horizontal line half – way between the extremes of undulation. But, so long as any life remained in the plant, this medial line did not run level, but was jagged with sharp irregular ups and downs that represented in a visible symbol the spasms of a murdered creature desperately struggling for life. After a little while, there were no more ups and downs. The line of dots was quite straight. The plant was dead.

The spectacle of a dying animal affects us painfully; we can see its struggles and, sympathetically, something of its pain. The unseen agony of a plant leaves us indifferent. To a being with eyes a million times more sensitive than ours, the struggles of a dying plant would be visible and therefore distressing. Bose's instrument endows us with this more than microscopically acuteness of vision. The poisoned flower manifestly writhes before us. The last moments are so distressingly like those of a man that we are shocked by the newly revealed spectacle of them into a hitherto unfelt sympathy.

Sensitive souls, whom a visit to the slaughter – house has converted to vegetarianism, will be well advised, if they do not want to have their menu still further reduced, to keep clear of the Bose Institute. After watching the murder of a plant, they will probably want to confine themselves to a strictly mineral diet. But the new self – denial would be as vain as the old. The ostrich, the sword – swallower, the glass eating fakir are as cannibalistic as the frequenters of chophouses, take life as fatally as do the vegetarians. Bose's earlier researches

on metals – researches which show that metals respond to stimuli, are subject to fatigue and react to poisons very much as living vegetable and animal organisms do have deprived the conscientious practitioners of ahimsa of their last hope. They must be cannibals, for the simple reason that everything, including the 'inanimate' is alive.

GLOSSARY

Experimenter (n) /ɪkˈspɛrɪmɛntə/ : (M) a person who performs a scientific procedure in a laboratory to determine some thing
(U) Each experiment was tested by a trained experimenter.

Canister (n) /ˈkanɪstə/ : (M) a samll vessel, usually of metal, for tea, etc.
(U) I have a large canister of tea in the kitchen.

Faraday (n) /ˈfarədeɪ// : (M) Michael Faraday (1791-1867), English scientist who made major contributions in the field of electricity

Juxtapose (v) /ˌdʒʌkstəˈpəʊz/ : (M) Place side by side
(U) The juxtaposition of the original painting with the fake clearly showed the differences.

Twitch (v) /twɪtʃ/ : (M) pull with a jerk, move
(U) His body twitched and then lay still.

Clockwork (n) /ˈklɒkwəːk/ : (M) a system of springs and wheels that you turn with a key or handle to make some clocks, toys and other devices operate
(U) Quartz watches are more accurate than those driven by clockwork.

Copious (adj) /ˈkəʊpɪəs/ : (M) plentiful, abundance
(U) He wrote copious notes.

Expound (v) /ɪkˈspaʊnd,ɛkˈspaʊnd/ : (M) explain, interpret
(U) He was expounding a powerful argument.

Shudder(v) /ˈʃʌdə/ : (M) shake, shiver
(U) She still shuddered at the thought of him.

Exhale (v) /ɪksˈheɪl,ɛksˈheɪl/ : (M) breathe out
(U) She sat back and exhaled deeply.

Anesthetic (n) /ˌanɪsˈθɛtɪk/ : (M) a substance that induces insensitivity to pain
(U) The use of chloroform as an anaesthetic is very popular.

Barometer (n) /bəˈrɒmɪtə/ : (M) An instrument measuring atmospheric pressure
(U) This survey is considered to be a reliable barometer of public opinion.

Caffeine (n) /ˈkafiːn/ : (M) a chemical substance found in coffee and tea plants and is a stimulant of the central nervous system.

Undulations (n) /ˌʌndjʊˈleɪʃ(ə)n/ : (M) rise and fall
(U) The road follows the undulations of the countryside.

Jagged (adj) /ˈdʒagɪd/ : (M) rough and with sharp points
(U) The jagged edges gashed their fingers.

Endow (v) /ɪnˈdaʊ,ɛnˈdaʊ/ : (M) provide with a quality, ability or asset
(U) He was endowed with tremendous physical strength.

Manifest (adj) /ˈmanɪfɛst/ : (M) clear or obvious to eye or mind
(U) Her manifest charm and proven ability was appreciated by all.

Writhe (v) /rʌɪð/ : (M) make twisting
(U) He writhed in agony on the ground.

Slaughter (v) /ˈslɔːtə/ : (M) kill for food
(U) Thousands of calves were exported to the continent for slaughter.

Self-denial(n) /sɛlf-dɪˈnʌɪ(ə)l/ : (M) self - sacrifice
(U) The farm has been built up over the years by hard work and self-denial.

Ostrich (n) /ˈɒstrɪtʃ/ : (M) A very large bird from Africa that cannot fly
(U) The ostrich is the flightless swift-running bird.

Chop-house /tʃɒp/ /haʊs/ : (M) cheap restaurants

Fatigue (n) /fəˈtiːg/ : (M) extreme tiredness resulting from mental or physical illness.
(U) He was nearly dead with fatigue.

Inanimate (adj) /ɪnˈanɪmət/ : (M) not alive, lifeless
(U) He looks at me as if I'm an inanimate object.

Cannibal (n) /kanib(ə)l/ : (M) a person who eats the flesh of other human beings.
(U) There are cannibals even today in some parts of the world.

About the author

Aldous Huxley (1894-1963), a well known English writer was born on 26th July 1894 in Godalming, Surrey of England. He had his graduation with English literature from Balliol College. In the beginning of his career, he published short stories and poetry. He worked as an editor for the literary magazine 'Oxford Poetry'. By the end of his life he became an outstanding personality. He was nominated seven times for the Nobel prize in literature. *The Perennial Philosophy* (1945), *The Doors of Perception* (1954), *Brave New World* (1932) and *Island* (1962) are his famous books. The essay 'J C Bose' is taken from his book *Testing Pilate*. In the eassy, he explains the simple instruments which were used by Michael Faraday and Jagadish Chandra Bose in their experiments. He also describes the views and experiments of Bose on plants.

About the lesson

In the essay, J C Bose, Aldous Huxley discusses a serious subject of plant life in a homorous way. He also writes about the experments of J C Bose in the Bose Institute at Calcutta.

Huxley feels that for the experimentation of science and technology, it is not necessary to have an advanced kind of instrumentation, rather it can be based on the curiosity and special talent of the experimenter. He gives the example of simple instruments such as tea vessel, silk wire, sealing wax and jam pots which were used by Faraday to invent the powers of electricity.

One day, Huxley happened to visit the Bose Institute at Calcutta where he met Sir Jagadish Chandra Bose, a great Indian scientist who proved by experimentation that both animals and plants share much in common and invented the instrument called the crescograph to measure the growth of plants. There, he observed the simple equipment used by Bose to make visible the growth of plants. He felt that the equipment used by Bose was more simple than that used by Faraday. Bose used a little clockwork, some needles and some filaments in his experiment. Huxley observed the experiments made by Bose such as, the growth of a plant being identified automatically with a needle on a sheet of smoked glass, reaction of a plant to an electric shock, feeding of a plant, transplantation of an anaesthetised tree and the recording of heart beats of a plant.

Huxley observed that a tree was transplanted from one place to another place with the help of chloroform. An overdose of chloroform is as deadly to a plant as to a man. He saw a plant dying of it. The plant struggled for life like a dying man would do. The sight of a dying animal is very painful to us. The people with delicate hearts may become vegetarians after observing slaughter houses. But there is life in the vegetables and also in the minerals and metals. When the people do not have anything to eat, they have to eat one another. So the writer says humorously that they must be the man-eaters.

Thus, Huxley explains the wonderful discoveries of Bose about plant life and suggests that a plant is as lively as a human being and that it should be protected and developed in large scale to maintain a healthy atmosphere.

CHECK YOUR UNDERSTANDING

Answer the following questions in a line or two

1. Who is Faraday?
2. What are the instruments used by Faraday in his experiment?
3. Who is J C Bose?
4. Where is Bose's Institute located?
5. What is the Crescograph?
6. What is clockwork?
7. What does the movement of needle on a sheet of smoked glass prove?
8. What does Bose's little bell experiment prove?
9. What does Bose conduct before transplanting a large tree in the garden?
10. What is the meaning of inanimate?

Answer the following questions in 10-15 lines each.

1. Explain the views of Huxley about the instruments for experimentation.
2. Explain the experiments of Bose about the growth and reaction of a plant.
3. How did J C Bose record the heart beats of a plant?
4. How did J C Bose prove that plants experience pain like other living beings?

Annotations

Annotate the following in 10-15 lines each. A model annotation in given below.

1. The mysterious powers couldn't help surrendering. So simple - if you happened to be Faraday.

   Context These lines are taken from the essay 'J C Bose', written by Aldous Huxley. In this essay, he explains about the different instruments used by Faraday and Bose in their experimentation and also explains the different experiments conducted by J C Bose.

   Explanation Huxley feels that for the experimentation of science and technology, it is not necessary to have an advanced kind of instrumentation. It is based solely on the curiosity and special talent of the experimenter. He gives the example of simple instruments such as tea vessel, silk wire, sealing wax and jam pots which were used by Faraday to invent the mysterious powers of electricity.

   General Relevance Huxley says that with simple and available instruments, scientific experiments can be made possible. The students should develop the strong desire and interest in science and technology. The great scientists conducted experiments with simple instruments and became successful.

2. We watched the growth of a plant being traced out automatically by a needle on a sheet of smoked glass.

3. Walking the anaesthetized tree immediately took root in its new place and flourished.

4. A mortal dose of chloroform was dropped in to the water. The graph became the record of a death agony.

SPEAKING SKILLS

Telephonic Skills

The telephone is very much a part of our lives. It is very important to learn how to use English to make a telephone call, answer the telephone, greet the person at the other end of the line, ask for someone and respond when someone else makes a request.

Read the following dialogues and you will find out how to handle telephone calls.

1. The telephone rings in the office of EMESCO Books Publishing Company, Vijayawada.

Receptionist : Good morning sir! EMESCO Books Publishing Company.
Caller : Could I speak to the sales manager, please.
Receptionist : Could I tell him who's calling, please.
Caller : My name is Lavanya. I'm calling from Govt. Women's Degree College Library, Visakhapatnam.
Receptionist : Thank you ma'am. I'll put you through to Mr Arun Misra, the sales manager.
Caller : Thank you.

2. The phone rings in Surya's home and his friend speaks to him.

Surya : Hello, who's speaking?
Caller : Hey Surya! It's me, Sunil.
Surya : Hi Sunil! I'm happy to hear you. Where've you been all these days?
Caller : I was at the cricket coaching camp.
Surya : Good for you. How did it go?
Caller : Great! Let's meet this evening. I'll tell you all about it.
Surya : Yes, let's. I'll meet you at the canteen.
Caller : Right. Bye.
Surya : Bye.

3. Dealing with a wrong number. The phone rings in Krishna Murthy's home.

Krishna Murthy : Hello!
Caller : Hello, can I speak to Dr Narasimha, please?
Krishna Murthy : Which number do you want?

Caller : 9440450742.

Krishna Murthy : I'm afraid you've got the wrong number. This is 9440450752.

Caller : Oh, I'm sorry.

Krishna Murthy : That's okay.

4. **Making enquiries on the phone. The phone rings in a railway enquiry office.**

Railway enquiry : Good evening, Railway enquiry!

Caller : Could you please tell me when the LalBagh Express to Bangalore leaves.

Railway enquiry : At 5.30 in the morning, sir.

Caller : Is it a daily train?

Railway enquiry : Yes, sir. It is a daily train.

Caller : Thank you very much, sir.

Railway enquiry : You're welcome!

Exercise

I. Look at the following expressions used in both formal and informal situations to answer the telephone, ask for someone and leave a message . Read each item and repeat it for practice.

Can I speak to the manager?

Could I talk to Mr Narendra, please?

May I know who's speaking?

Would you like to speak to the principal?

Hold the line, please.

Could you hold the line, please?

Sure, I'll hold the line. Thanks!

I'm sorry. I must have got the wrong number.

Could you repeat the number please?

He's gone out. Can I take a message?

Would you like to leave a message?

Could I leave a message, please?

Could you tell me when the Rajadhani Express leaves?

What would be the fare to Bhopal?

Could you tell me how much a ticket to Kurnool, please?

VOCABULARY

Some more roots.

Temp =

Temporal = of time
Temporary = of a short time
Contemporary = belonging to the same time
Extempore = no time for preparation, said or done without preparation
Tempo = timing / a frequency
Temporize = to delay in order to gain more time to do something
Tempest = a storm that comes at a certain time
Temp = a worker hired for a short period of time, a temporary employee

Rupt = burst/break

Erupt = bursting out (such as lava from a volcano)
Disrupt = bursting apart (there by to throw into confusion or disorder)
Interrupt = burst between or among (which results in disturbing or stopping the work)
Abrupt = bursting away (sudden, curt)
Rupture = burst
Bankrupt = burst bank account (so unable to pay one's debts)
Corrupt = thoroughly burst morals
Irrupt = burst in, to enter forcibly uninvited

Fort = strong

Fort/fortress = a strong building
Fortify = to make strong
Effort = putting a strong work forth
Effortless = not requiring strength
Comfort = thoroughly strong
Discomfort = not thoroughly strong
Fortitude = strength of character
Force = strong power

Arch = rule

Archon = ruler
Monarch = single ruler

Oligarchy = rule by a small group of powerful people

Matriarch = a female rule over a small community

Patriarch = a male ruler over a small community

Anarchy = a system where there is no rule

Hierarchy = levels of rule within a system

Archive = historical documents kept safe by rulers of a government

Labour = work

Labourer = worker

Laborious = full of work

Laboratory = place where scientists work

Collaborate = work together

Elaborate = to work out a problem/ fully worked out

State whether Yes/No

1. A classroom without a teacher may be an example of anarchy. Yes/ No
2. Mental or emotional strength that enables one to face difficulty may be called fortitude. Yes/No.
3. In a family, father with the collaboration of mother brings up children. Yes/ No.
4. If you are corrupt, you have fortitude. Yes/ No.
5. Does a volcano erupt? Yes/ No.
6. Are your classmates your contemporaries? Yes/ No.
7. Is monarchy same as oligarchy? Yes/No.
8. If you need a detailed explanation about roots can we call them 'elaborate roots'? Yes/No
9. Do you practice a lot for an extempore? Yes/No.
10. Everyone likes to be interrupted while doing some serious work. Yes/ No.
11. To fortify your vocabulary you need to work with roots. Yes/ No.
12. Do you like an abrupt ending for a story? Yes/ No
13. When asked a sudden difficult question, usually people temporize to answer it. Yes/ No.
14. Is Vijay Mallya bankrupt? Yes/No.
15. Is learning vocabulary a laborious process? Yes/ No.

    (Answer the above question sincerely ☺)

THE SOUNDS OF ENGLISH

Mastering English pronunciation must begin with learning the sounds of the language. Speakers of Indian languages may find some sounds of English difficult to produce because these do not occur in their native languages. For example, native speakers of Telugu and Hindi may take time to learn how to produce the sound [ɔ:] in the middle of words such as 'caught' [kɔ:t] and 'ball' [bɔ:l]. This is because this sound does not appear in Telugu or Hindi and has to be learnt as a 'new' sound.

The forty-four sounds in English are broadly classified into consonants and vowels. There are 24 consonant sounds and 20 vowel sounds, of which 12 are monophthongs (pure vowel sounds) and 8 are diphthongs (a combination of two vowel sounds). This classification is based on the basic nature of the sounds, which is a result of the mechanism involved in their production.

To identify these sounds, we use a system of written symbols called the International Phonetic Alphabet (IPA). You will see that while some of the IPA symbols are the letters of the English alphabet, there are other special symbols as well. Dictionaries use phonetic symbols to give the pronunciation of words. The exact representation of the pronunciation of words using these symbols is called phonetic transcription, which is a useful tool in learning to pronounce words correctly.

Look at the following table listing the consonants and the vowels of English and the phonetic symbols used to represent them. Each sound in the list is accompanied by a word containing the sound concerned (the sound is underlined). For practice, first say the sounds aloud and then the words given as examples. Your teacher will help you practise the sounds that you are not familiar with.

Vowel sounds (Monophthongs)				**Vowel sounds (Diphthongs)**		
ɪ	**i:**	ʊ	**u:**	ɪə	**eɪ**	
ship	sheep	book	shoot	here	wait	
e	ə	ɜ:	ɔ:	ʊə	ɔɪ	əʊ
bed	teacher	bird	door	poor	coin	show
æ	ʌ	ɑ:	ɒ	eə	aɪ	əʊ
hat	up	far	on	hair	like	mouth
Consonant Sounds						
p	**b**	**t**	**d**	**tʃ**	**dʒ**	**k**	**g**
sheep	boat	tree	dog	cheese	joke	cook	go
f	**v**	θ	ð	**s**	**z**	ʃ	ʒ
free	video	thing	this	see	zoo	sheep	television
m	**n**	ŋ	**h**	**l**	**r**	**w**	**j**
mouse	now	thing	hope	love	run	we	you