Research Methodology
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Lecture - 67
Ethical Conduct in Science: Aspects of Scientific Ethics

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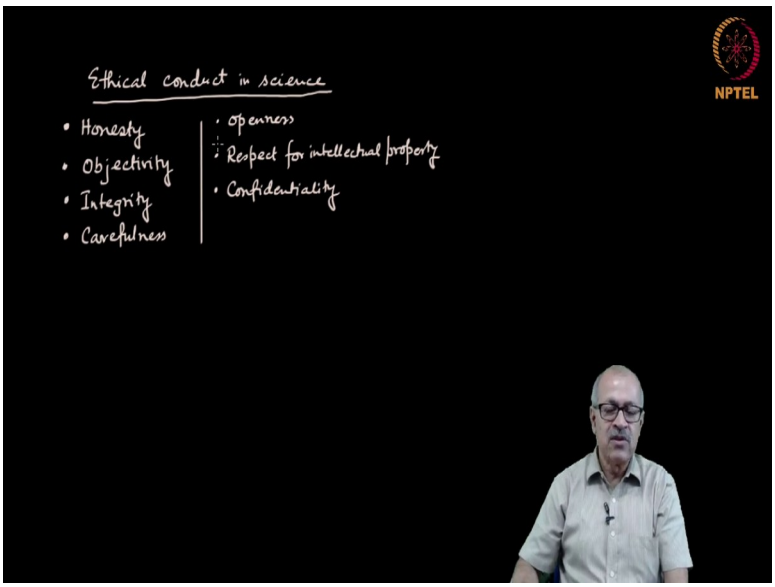

Today we will come to the very important issue of Ethical Conduct in Science or scientific ethics. Now, there are such ethical issues in all professions, all human activities. Those are considered ethical which foster that specific area of human activity, which help that area of human activity to flourish, and those which undermine that, these are considered to be unethical.

Normally these evolve through ages and certain practices are considered to be ethical, certain practices considered to be unethical. A consensus emerges within the community. Similarly, there are ethics in football. Those conducts which help that particular game to be strengthened, enriched, flourish -- these are considered to be ethical practice, and now these are codified. One knows what is ethical or what is unethical.

Similarly in science, you have certain conducts considered as ethical practice, certain conducts considered as unethical practice. Science is an organized activity of learned individuals engaged in the practice of finding out the mysteries of nature, finding out the laws of nature.

Since it is a organized activity of a large number of human beings, here also there are issues of ethical conduct and unethical conduct. A student has to be very knowledgeable about what constitutes ethical conduct and what are considered to be unethical. Without that, one can either recklessly commit an error or one can unknowingly be victim to a practice. All these are detrimental to the health of science, also to the individual. So it is necessary that we know what constitutes ethics of science.

Now, there are certain normal behaviors that are considered to be pillars in the ethics of science. I will enumerate them.

Like in most other fields, in science also, the most important and the first point that I will write is honesty. In every field, honesty carries a meaning. In science also, honesty carries a meaning. For example, you have to be honest in all scientific communications. You have to be honest in conducting your research. You have to be honest in conducting experiments. You have to be honest in reporting data in results, methods. Honestly you have to do that.

This means that, if you have failed in doing something, then that has to be honestly admitted. If your results do not really lead to a proper conclusion, the conclusion is ambiguous, then that has to be honestly admitted. If you do not know something then you have to admit that I do not know. After all, science starts with not knowing something. So, not knowing something is not a discredit in science. But not knowing something, but pretending as if you know that is a mark of dishonesty.

So, you have to be careful that other people you are talking to might be knowledgeable in that field and if you do not know something it is better to admit I do not know. Unethical practice, I will come to a little later, but it is obvious that honesty in science means that you would report the outcomes of an experiment honestly. You will not fabricate data. You will not drop data points without citing reasons for that. You will do the appropriate statistical test and so on and so forth, these are components of honesty.

The next point is objectivity. That is the hallmark of science. I have spent enough time in explaining what objectivity means in science. We have learnt that there are two ways of thinking, subjective thinking and objective thinking.

Earlier times the thinking process was subjective, but as science came, we adopted the objective way of thinking. Now, any scientific pursuit has to be objective. So, we have to take every measure in order to avoid the possibility of my subjective judgment, my subjective beliefs, influencing my research results.

How it is done -- that is something I have already covered. You do single blind test or double-blind test depending on the situation. And there are various other measures that we take in order to prevent my own beliefs interfering with my results. So that is objectivity.

When do we fall victim to subjectivity? It normally happens when I have a belief, I believe in a expected outcome of the experiment, the experiment should give this result, and then if it does not, then my mind is unsettled. I try to tweak here and there, and that is the hallmark of subjective things coming in the way of science.

One has to be very objective in data interpretation, in peer review, and so on and so forth. Some time you will become a reviewer of a paper. The Associate Editor of a journal will send you a paper to review and there you have to be completely objective. You cannot judge the paper on the basis of who wrote the paper, who has been cited and all subjective considerations. Rather the merit of the paper objectively should be judged. These are the issues of objectivity. Most importantly you should plan experiments and other parts of scientific research in an objective manner.

Then comes integrity: integrity means keeping to your promise. If you make a promise to deliver something or if you enter into an understanding through a MOU or maybe some agreement with somebody, a company or a funding agency, then these have to be honored. That is a question of scientific integrity.

You have to be consistent in your thoughts and action. If there is any conflict of interest, it has to be declared upfront. Let me cite examples. Suppose you are a well known scientist and you are called to give your verdict, your scientific opinion, expert opinion on an issue, say, climate change: what we should do? And suppose that you have made an investment in a company that produces alternative products and you are making a recommendation to the government to use that product.

Even though it might help in countering the climate change or greenhouse effect or something like that, you have to declare that I have a financial interest in that. If a paper comes to you for review and you know the authors and you have had earlier discussion with the authors on that content, then obviously, you have to state that: “no I cannot review this paper because there is a conflict of interest”.

If you are on a selection committee and there is somebody who is known to you: your relative or something like that, and he or she is a candidate. You have to then declare that, no, I cannot sit in judgment of that person because of this reason. So, these are issues of scientific integrity.

Especially when a scientist is called to give opinion on a topic of national interest, his expertise is called upon, then the scientist is expected to be absolutely objective. There should be no subjective consideration, no consideration on whether or not the verdict or the opinion he or she gives will be favored by the powers that be, thereby earning him or her some favor in the governmental circles. These are typical cases where a scientist might err and one has to follow the demands of scientific integrity.

The next is carefulness. You have to be careful in conducting your research, especially experiments. If you take the data carelessly, the data will be erroneous and naturally these will lead to erroneous conclusions. This might mislead many others when such a paper is published and so you have to be very careful.

Erroneous data obtained through careless practice are normally detected. Maybe you get the paper published because when you submit the paper, the experiment is not repeated by somebody else or the reviewer, but when the paper is published somebody or other around the world will repeat the experiment. And if you have are done something wrong, it will be detected. That leads to disgrace for the scientist.

So, it is necessary to be careful. But a careless mistake is not considered to be a crime, it is considered to be an error, something that you should not do. But something that is recklessly done, knowingly done, that constitutes an unethical conduct. So, you have to be careful. If somehow you are erring in favor of being careless, then it is a problem.

The next point is openness. Science thrives on open exchange of information and ideas between scientists. If one is not open, one is secretive, then he/she says “I have an idea, I

will keep it to myself". Many people actually do that and it is detrimental to the health of science. If you openly discuss your ideas with others, then maybe they will be able to enrich the idea, they will put their ideas along so that your idea is enriched and you can do the experiment, you can conduct the research in a better way.

So, whenever we go to a conference or we speak to somebody, some peer, over a cup of coffee, over a lunch or dinner, we discuss science and then we toss around our ideas. That is actually good for the health of science in general and good for your own science in particular.

You have to remember that the knowledge that you have obtained has been obtained because our predecessors, the earlier generations, whatever they learnt, they made that knowledge available to everybody. That is how you got that knowledge. So, it is ethically binding on us that whatever we find, whatever we discover, whatever advancement we make, we should make it available to the next generation openly.

This is a demand of ethical conduct of science: openness. You might say that, "if I discuss my ideas with others during a conference, something that I have not published yet, can he or she not steal my ideas?" Well, it is not that it cannot happen. But these are very rare, and often committed by unscrupulous people who are also very rare among the scientific community.

For example I, whenever I go to a conference, I talk freely about the kind of work our students are doing right now, much later they will be in a position to publish, but what results we have got, what ideas we are pursuing, we discuss freely. And I have always been enriched by the discussions that we had. So, it is a good practice to be open. So, the data, the tools, the techniques, the resources -- all should be openly shared with others, because that practice is conducive to the growth of science in general.

Then the respect for intellectual property. An intellectual property comes in a few different forms. A, patents: if somebody has taken a patent then that patent is his or her intellectual property and it is expected that some company will buy that patent, commercialize that product or process. Thereby it will come to use. The ideas that go into that patent are considered, therefore, to be intellectual property of that individual and you have to respect that.

Whenever somebody publishes in a journal, for example, then one has to transfer the copyright, the intellectual property, to the publisher. Then the content of that paper becomes the intellectual property of the publisher. Therefore, if you want to quote from that, if you want to take a figure from that in another place, say, you are writing a book or another paper in which you want to use the image or a few lines, then you have to appropriately seek permission for doing that.

Often when we are writing a review paper or we are writing a book, we might need to get pictures, tables, data, even specific wording of sentences from others' work. In that case these have to be appropriately referenced, so the source is known to the reader. Secondly, before you do that, you have to seek permission of not only the author, but also the publisher, because the publisher owns the copyright.

You have to give credit wherever it is due. If somebody has published it, you have to be careful in citing that. You have to be careful in citing all the earlier work where a paper, in some way, has contributed to the knowledge based on which you are building your own work. That credit has to be given by citing the paper. That is also a part of respect for intellectual property.

There are situations, when, what I said about openness, this might not be desirable to protect, because there are issues of confidentiality. When do we need to make some finding confidential? When some funding agency has funded me and there is an agreement between the funding agency and me, that the outcome of the research will be kept confidential.

These things happen when the outcome of the research is, in the national scale, sensitive in nature. This can happen when a company is sponsoring the research and it expects the outcome of the research to be used by the company only and does not want it to be openly shared with everybody. So, if there is such an agreement prior to the start of the research, then you have to honor that confidentiality.

So, you have to honor confidentiality related to, say, military secrets, patent records and things like that. There is another thing that is considered to be a confidential document. If a paper comes to you for review, then you get to know the content of that research work, but it has not yet been published.

In that stage, it is considered to be confidential information. You are not supposed to tell everybody what that paper that has come to you for review contains.

There is also another confidentiality issue that we have to honor in publication. We have to be responsible. So, what does responsible publication mean? Responsible publication means that whenever I have got a result that is new, novel, and I need to let people know about this result, then it is a responsible publication. But, if I do not have new results and yet I want to publish, just to increase my publication count, just by taking material from here and there, maybe from my earlier publications and then just publish for the publications sake.

Publication for the sake of increasing the publication count, wasteful duplicative publication -- these are irresponsible publication. So, we have to publish, but we have to publish responsibly. Whenever we need to publish, we should publish. Irresponsible and duplicative wasteful publication, publications that are actually do not contain anything new -- these are issues of unethical practice in science.

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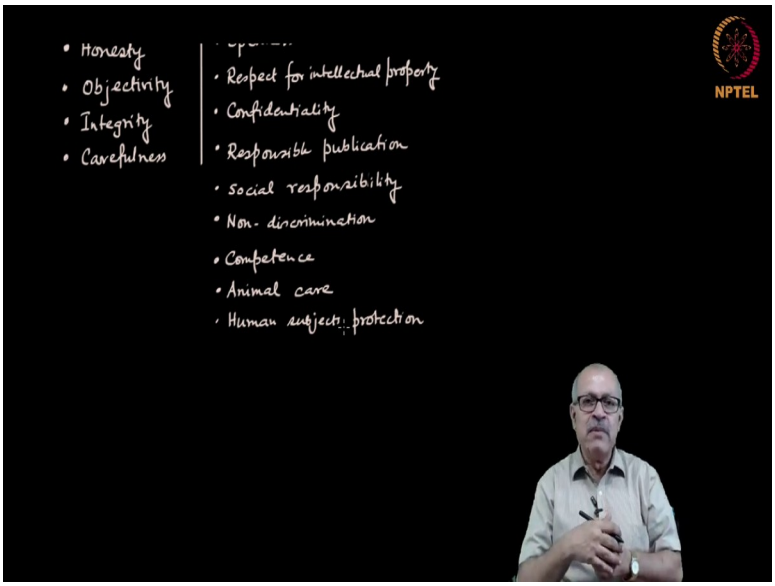

Then I will write ‘social responsibility’. The issues of social responsibility come from two angles. The first is, the knowledge that you have gained by engaging in scientific research, that knowledge, the outcome of that research, should not be used for the destruction of mankind, for any destructive purpose. Something that harms mankind or

nature. So, that is one elementary social responsibility of a scientist. My knowledge, the outcome of my research, should not be harmful for the society.

Why do I mention this? Because it is everywhere. You have heard of food adulterants, which are also chemicals. These could not have been invented without the participation of some chemist. The killer gases that were used in the first and the second World War, these are also the products of chemistry. Somebody's scientific mind went into inventing things that are actually detrimental to the progress of mankind. So, these are to be avoided.

That is one aspect. The second aspect is that, as scientists, we are a privileged section of the society. Most people in the society did not get the opportunity of learning science to the extent that we have. Many are, as you know, in India, illiterate. Many drop off after the primary level; many drop off after the school level. So, they do not get the opportunity learning science to this extent. As a result many unscientific beliefs and superstitions rule their mind.

Now, if we are scientifically literate, it is our social responsibility to convey the ideas of science, not exactly the information of science, but how science teaches you to think, scientific rationality, scientific temper, we should strive to convey that to the people around us. So, that is another social responsibility.

So, social responsibility comes from two angles: one is that our research should not contribute to destruction of mankind, harm mankind; the other thing is that we should actively help building a scientific bent of mind among the people.

If you, at some point of time in your scientific life become a administrators, then you have to practice non-discrimination. Discrimination on the basis of sex, race, religion, in India caste -- all these are too prevalent, and so it is necessary for a scientist to be consciously aware of these discriminations that are existing in the society and actively try to counter that discrimination. So, even when you are not an administrator, you have something to do on that.

Even though the ratio of male and female is 50-50 in any society, you will find that in scientific pursuit the number of women is much smaller. Why? Because the society has given a specific kind of role to women, which is not scientific and the scientific

community has to actively counter that, bring women to the centerfold of scientific activity.

Similarly, the children of the downtrodden people, economically challenged people, the people coming from the lower castes, we have to bring them into the ambit of science and naturally the non-discrimination becomes a very important issue.

Then I have to write something that often people ignore. That is competence. We often assume that we are competent to do what we are doing. But competence is not a 1-0 thing. Competence is something that you have to continuously increase. You have to improve your competence in undertaking the activities that you are undertaking.

Your ability, your competence, your knowledge base -- all that has to increase continuously. Otherwise you will be left behind. Science is progressing continuously and unless you continuously learn, you will be left behind. You will tend to believe that you know, but actually your knowledge will be backdated.

So, the competence has to be continuously increased, you have to cultivate competence continuously. Incompetent people in the area of science is dangerous, and incompetent people in the area of administration of science is extremely dangerous. So, we have to be very careful to ensure that you are not in that position.

Whenever you are conducting an experiment using animals, you have to be very careful about caring for the animals. In animal experiments you have to take ethical clearance and things like that, but these are clearances. In your personal conduct with the animals you have to be careful not to harm the animals. Even if the experiment demands you to inject something, make the animal sick, or things like that, also has to be done with compassion, minimizing the suffering of that animal as much as possible.

If you are doing the experiments with human subjects, then the welfare of that human is in your hands and you have to be sensitive to that. A, the identity of that person should not be divulged among everybody. B, the welfare of that person, wellbeing of the person, has to be looked into, so that his wellbeing is not harmed in any way through that experiment.

So, you have to honor the dignity and privacy of that individual, even while you are conducting the experiment. You have to take spatial precautions when doing an experiment with vulnerable populations and you have to strive to distribute the results of the research evenly so that there is a clear indication that you are sensitive to the well being of the fellow humans.

These, more or less, are the points I wanted to make regarding what constitutes ethical conduct in science.