

CHAPTER V

SCIENCE OLYMPIADS

The National Board of Higher Mathematics (NBHM) of the Department of Atomic Energy (DAE) initiated activities leading to India's participation in the International Mathematics Olympiad (IMO) from the year 1989. The need for a similar National Olympiad Programme in basic sciences was recognized at the same time in several quarters. It was felt that with a large base of quality human resources in science, the country must also participate in the International Olympiads in physics, chemistry and biology.

In 1997-98, Homi Bhabha Centre for Science Education (HBCSE), a National Centre of the Tata Institute of Fundamental Research (TIFR), Mumbai and the Indian Association of Physics Teachers (IAPT) jointly took the initiative in starting the Physics Olympiad Programme. Next year, HBCSE took steps to extend the programme to chemistry and biology. IAPT came forward to extend its wide network facility in conducting examinations in chemistry and biology. These moves received strong support and encouragement from the DAE, Department of Science and Technology (DST) and the Ministry of Human Resource Development (MHRD) of the Government of India. India sent its first team to International Physics Olympiad (IPhO) in 1998, International Chemistry Olympiad (IChO) in 1999 and International Biology Olympiad (IBO) in 2000. The good per-

formance of the Indian teams right in the first few years of participation helped in consolidation of the programme. India hosted the International Mathematics Olympiad in Mumbai in July 1996. Five years later, India hosted the 33rd International Chemistry Olympiad (IChO) in Mumbai from July 6-15, 2001, just 3 years after its entry in the IChO.

INDIAN NATIONAL OLYMPIADS

(in Mathematics, Physics, Chemistry and Biology)

The Indian National Olympiad examinations in different subjects (INMO, INPhO, INChO, INBO) are held between the end of January and beginning of February annually at a dozen or more centres in the country. They are the most challenging tests available in India at the pre-college level, patterned after and comparable to the high academic level of the International Olympiads. The National Science Olympiads also include a serious experimental test, a feature absent even in the best entrance examinations in the country for entry to professional courses (engineering, medicine, computer science) after the senior secondary school. Eligibility to appear for the Indian National Olympiads is decided on the basis of an all India examination — the Regional Mathematics Olympiad held in December every year and the National Standard Examination in Physics, Chemistry and Biology held in November each year. These

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JAWAHARLAL NEHRU

first stage examinations are held at about 20 centres in mathematics and at a very large number of centres in the case of sciences. About 25000 students enroll for the first stage National Standard Examination in Physics, and a somewhat lower number in other subjects. Out of these, about 200 to 300 students are selected to appear for the National Olympiads. On the basis of their performance, the top 30 to 35 students are short-listed in each subject. These are the National Olympiad winners/awardees. For these awardees, HBCSE organizes training camps each summer in May-June. The Olympiad effort of HBCSE in physics, chemistry and biology and that of NBHM in mathematics involves a training programme assisted by a large number of resource persons invited from different parts of the country. Special Olympiad laboratories have been developed at HBCSE in the three science subjects for training in conducting experiments. Teams of 6 students in mathematics, 5 in physics and 4 each in chemistry and biology are selected at the end of camps to represent India at the International Olympiads every year.

INTERNATIONAL OLYMPIADS

The International Olympiads are the world's unique and most challenging academic competitions for young college students and are individual events. The medals (gold, silver and bronze), honours, special prizes, are allocated on the basis of individual scores using some agreed criteria usually laid down in the statutes of the particular Olympiad. The Olympiads are festive occasions — a celebration of science or mathematics at its best by its young participants and their teachers. Excursions, cultural programmes and other social

activities are an integral part of every International Olympiad. The aims of International Olympiads are not only to encourage young students to strive for excellence in their subjects, but also to promote friendship among students, teachers and scientists from various parts of the world.

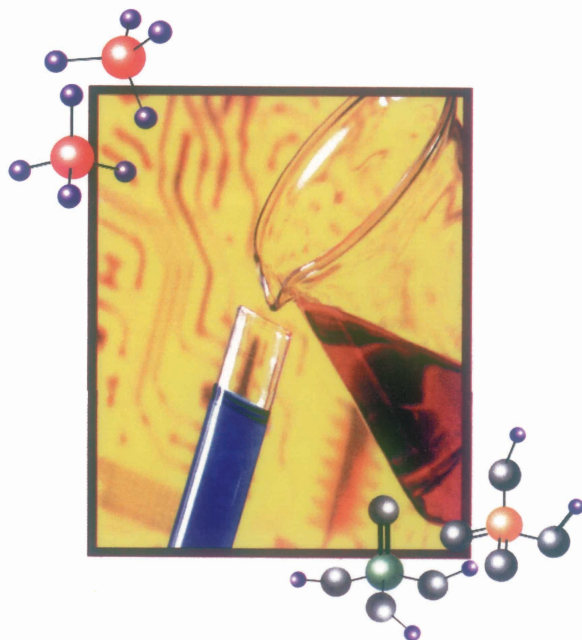
The International Olympiads in mathematics, physics and chemistry started three to four decades ago. IMO is the oldest; it started in 1959; IPhO in 1967 and IChO in 1968. The IBO is relatively recent; it started in 1990. Their genesis lies in the early initiatives in East European countries and the former USSR which laid strong emphasis on mathematics and science in their school syllabi. Gradually, the movement picked up, with more and more countries participating each year. In 2001, eighty-three countries took part: IMO (83), IPhO (65), IChO (54) and IBO (38). In addition to the contesting countries, a few observer countries send their representatives with a view to participating in future. The syllabus for IMO is, broadly speaking, pre-calculus mathematics — number theory, combinatorics, geometry and algebra. The syllabus for IPhO encompasses all parts of classical physics including elementary relativity and modern physics but not formal quantum mechanics.

Performance of Indian Teams at the International Science Olympiads (1999-2001)

| Subject/No. of participants sent | Year | | |
|----------------------------------|------------------|---------------------|----------------------|
| | 1999 | 2000 | 2001 |
| Mathematics (6 students) | 3 Silver | 5 Silver | 2 Gold |
| | 3 Bronze | 1 Bronze | 2 Silver 2 Bronze |
| Physics (5 students) | 4 Silver | 2 Gold | 3 Gold |
| | 1 Bronze | 2 Bronze 1 Merit | 2 Silver |
| Chemistry (4 students) | 2 Silver | 2 Silver | 1 Gold |
| | 2 Bronze | 2 Bronze | 3 Silver |
| Biology (4 students) | No participation | 1 Silver | 1 Gold |
| | | 3 Bronze | 3 Silver |

The syllabi for IChO and IBO are vast and for bidding, which is why it is a practice in IChOs to send out a set of Preparatory Problems to all participating countries several months before the contest. In IBO, the areas to be stressed in the laboratory contest are announced one year in advance.

There are several other subjects in which International Olympiads are organized. Of special mention is the International Astronomy Olympiad. This is so far restricted mainly to the countries of the former USSR. The Astronomy Olympiad Programme is supported by the ISRO and the Astronomical Society of India. Indian



The logo of 33rd International Chemistry Olympiad, Mumbai, India 2001.

teams have started participating in the Astronomy Olympiad from 1998 and their performance has been highly commendable. There is also another important Olympiad, namely the International Informatics Olympiad in which our country is yet to participate. One Observer is likely to participate this year and the regular Indian participation may begin next year. Some private Olympiads (i.e.



The winning Indian team at the 33rd International Chemistry Olympiad, Mumbai, July 1-15, 2001.

those in which teams are not officially sponsored by the respective governments also exist, as for example, in Robotics).

HOSTING OF INTERNATIONAL OLYMPIADS BY INDIA

It is a tacit obligation of every participating country to offer to host an International Olympiad sometime. India hosted the 37th IMO (5-17 July, 1996) in Mumbai. 75 countries participated in this event with 424 contestants. NBHM (DAE) and MHRD provided financial support. The event was a great success and attracted much attention.

More recently (July 6-15, 2001), India hosted the 33rd IChO in Mumbai. Fifty-four countries (with 210 contestants) and 6 observing countries participated in the event. India's ability to hold this mega event so early after its entry into IChO and at a short notice of less than a year received much acclaim from the IChO community. The 33rd IChO has resulted in a tremendous mobilization of expert resources for the chemistry Olympiad activities in India. Some of the top chemists of the country have become excited about the programme and are willing to work for it. As Indian teams are doing well in physics, a similar exercise is desirable in this subject as well.

No student in any subject has returned without a medal/honour in the last four years since our participation in the Science Olympiads began. This is a remarkable achievement for any country, especially, in its early years of participation. The overall performance of Indian teams can be said to be commendable. In Physics, however, Indian teams are giving splendid performance for the last two years. The national rankings are unofficial and discouraged at many Olympiads. As an indicator, however, in terms of aggregate scores, in the year 2001, India ranked 7th out of 83 countries in mathematics, 4th out of 65 countries in physics, 7th out of 54 countries in chemistry and 6th out of 38 countries in biology. This is the best performance of our teams so far.

INCENTIVES AND AWARDS

The incentives/awards in the current Olympiad scheme in India differ from subject to subject. However, a major incentive, namely the *Kishore Vaigyanik Protsahan Yojana* (KVPY) Fellowship of DST is common to all subjects. All the 19 students (6 in mathematics, 5 in Physics, 4 each in chemistry and biology) who are members of the Indian teams at the International Olympiads automatically qualify for KVPY Fellowship (Rs.3,000/- p.m. + Rs 6,000/- p.a. contingency grant plus a nurture programme) provided they continue to pursue careers in science. An important career incentive is offered by BARC for the physics and chemistry students of this set. The 5 students in physics and 4 in physics and 4 in chemistry are offered direct admission to BARC Training School five years in advance, provided again that they pursue undergraduate and post graduate careers in sciences.

Students who are selected for the Indian teams in physics, chemistry and biology receive an award of Rs.5,000/- each at the end of the training programmes. The Award scheme in mathematics is slightly different. All the participants in the training camp are entitled to an award of Rs.5000/- each and students of the Indian team who received medals

at the Olympiad receive further cash prizes. In the year 2001, the Government of India have announced an award of Rs.5,000/- to each of the 19 students of the Indian teams who have received medals at the International Olympiads.

Despite these incentives and awards, most Olympiad students opt for professional courses in computer science, engineering, medicine, and so on. A systematic post-Olympiad follow-up of Indian students has not been undertaken so far—it needs to be done. Only a few of them have taken up careers in basic sciences/mathematics. But we are also aware of many more Olympiad students who continue to have strong interest in pure sciences and desire to turn to them sometime later after their basic professional degree—a fanciful thought perhaps but not wholly unrealistic. A couple of mathematics students are known to have done that. It is too early to assess if the Science Olympiads in India will help attract at least a reasonable number of Olympiad winners to take up a career in science. An assured career scheme is being mooted in some quarters that guarantees jobs to these students in good institutions of the country well in advance, provided they pursue careers in science. This scheme, a kind of extension of the current KVPY, is probably the best that can be attempted to arrest the trend of bright students opting out of basic sciences.

ANALYSIS AND PROSPECTS

The Olympiads have certainly generated considerable excitement and interest among the meritorious and motivated students of the country. This is evident from the increasing enrolment of students for the first stage examination year after year. A few observations on the positive features of the current Olympiad scenario in India, as also its inadequacies and possible measures to overcome them are given below.

- The Government of India is very supportive of the Olympiad Programme, with three major ministries (DAE, DST and MHRD) providing encouragement and financial aid to the activities.

- The senior secondary syllabi in India in the science subjects are by and large globally competitive.
- The entrance examinations for prestigious professional courses (in engineering, medicine, computer science, and others) in the country (e.g. IIT—JEE) are quite demanding. Students preparing for these examinations develop good skills in solving problems in many if not all the topics of the Olympiad syllabi.
- IAPT has played a significant role in the success of the Science Olympiad Programme in India. The National Standard Examination in Physics which IAPT has been conducting for many years has become an excellent first stage examination for the Olympiad programme. Indeed, one of the most important fall-out of the science Olympiad activities in India has been the strengthening of IAPT and the formation of new teacher associations along the same lines, namely, IACT and IABT.
- An important feature of the Indian Olympiad scene is the emergence of HBCSE (TIFR) as the nodal centre of the country for the Olympiad programmes in science and mathematics. Besides being a venue for training (especially, laboratory training) of the National Olympiad awardees in different subjects, the Centre plays a crucial role in mobilization of expert human resources from leading institutions of the country for Olympiad activities.
- The National Olympiad Programme, pitched at the level of senior secondary and above has no organic connection with the mainstream school education in India. The secondary

school education in the country rarely gives any opportunities of solving difficult problems or performing good experiments even to a limited number of good students. What is perhaps needed is an All India Junior Olympiad in Mathematics and Science pitched at the Class IX level. This will not only improve the input quality of students for the National Olympiads but also promote an Olympiad culture at least in some of the schools of the country.

- The present incentives for Olympiad students are not enough. In some countries, the national Olympiad winners automatically qualify for admission to courses in the coveted institutions. In India, however, the national Olympiad awardees have to concurrently prepare and appear for a large number of entrance examinations.
- Training of the Olympiad students is insufficient. It happens only once at HBCSE, in the summer prior to the International Olympiads. However, training, especially, laboratory training, needs to be started at different stages for longer periods. There is a need to have several zonal Olympiad centers where training in Olympiad kind of problems is provided and experiments could be carried out by local institutions and/or teacher associations.

Most of the limitations of the current Olympiad scene can be corrected with some effort and imagination. The concerned people are seized of the matter and, hopefully in the near future, the Indian Olympiad Programme in Science and Mathematics will become stronger and more comprehensive.

