

The changing face of the Chemistry Olympiad

A member of the International Chemistry Olympiad steering committee traces the history of and changes to this challenging annual event.

Australia has participated in the International Chemistry Olympiad (IChO) for some 18 years and hosted the event in Melbourne in 1998. Our nation is typically ranked in the top 25% of competing countries and has been ranked as high as fifth in the world, in Mumbai in 2001. Furthermore, the Australian team members have won a total of 70 medals out of a maximum possible of 76. Of these, 11 are gold (seven in the last six years), 19 are silver (15 in the last 10 years) and 40 are bronze, a truly remarkable performance.

For the uninitiated, the IChO is an annual competition for senior secondary school students, which takes place in a different country each year. Poland, which has had a national Chemistry Olympiad program in operation for over 40 years, was instrumental in founding the first international event, which was held in Czechoslovakia in 1968 and involved only three countries. Indeed, up until 1985 the IChO was a strictly European affair, the USA being the first non-European participant. Today in excess of 60 countries participate in this highly competitive annual event. Each national team competing at an IChO event comprises four students and two mentors. The competition itself consists of two gruelling five-hour exams (one practical exam and one theory paper), with the level of chemistry examined being at least equivalent to that taught at first-year university. Medals are awarded on

the basis of the students' combined scores for the two assessment criteria. Gold medals are awarded to the top $10 \pm 2\%$, silver medals to the next $20 \pm 2\%$ and bronze medals to the next $30 \pm 2\%$.

Since Australia began competing at the IChO in 1988 a number of changes have taken place at the international level. For example, the number of competing teams at an IChO event has more than doubled over this period of time and furthermore the level of competitiveness has almost certainly been raised. Throughout, Australia has managed to maintain and arguably enhance its competitive edge in no small part as a result of concomitant responses at the national level.

Each year selection for the national team begins with a national qualifying exam (NQE), which is sat by some 1200 upper secondary school students throughout Australia and the local region. Approximately 20 top students in the exam are invited to attend the scholar school, to face 14 hours per day of chemistry over a two-and-a-half week period, pitched at the first-year university level. Two lab exams are held during the scholar school followed by two theory papers that are sat in March at the scholars' respective schools. Medals are awarded to the students based on their performance in these four assessment criteria with a maximum of 12 medals (typically two gold, four silver and six bronze) being awarded each year. The top four students are invited to attend a further one-week chemistry camp over the Easter break and to represent Australia at the forthcoming

IChO. In 2007 the IChO will be held in Moscow in mid-July.

The national program had its beginnings in Canberra and owes its birthright to the inaugural director, Professor Richard Russell (currently Dean of Graduate Studies at the University of Adelaide). Through his vision, determination and undeniable brilliance in the teaching of organic chemistry the program slowly evolved over the next decade, culminating in Australia's successful bid for the 30th IChO in 1998.

There is no doubt that one of Australia's leading chemical educationalists has had a profound and lasting influence on the development of the national program, and the Chemistry Olympiad movement will be forever indebted (both at home and abroad) to him. The 30th IChO in Melbourne not only marked a historic milestone in our involvement in the Chemistry Olympiad but also is still recognised internationally as being one of the best. The involvement of the RACI in ensuring the success of the 30th IChO cannot be overstated.

The ensuing years have seen a major change in the organisational structure of the national Chemistry Olympiad program. It is one of three science-based programs that come under the umbrella of the Australian Science Olympiads (ASO), the other two being physics and biology. The ASO is one of the core programs of Australian Science Innovations (ASI). ASI also offer Rio Tinto Big Science Competition, an innovative program comprising a competition and an online component suitable for students of all abilities, and LabLinks, an online professional

Geoff Salem MRACI C Chem is at the Department of Chemistry, College of Science, Australian National University, Canberra, ACT.

development resource which encourages the use of information and communications technologies in science classrooms. ASI is an independent, non-profit organisation that is not only responsible for delivering the three national science-based olympiads but also encourages and promotes excellence in science education through its partnership with DEST, Rio Tinto and more recently Merck, Sharp and Dohme.

These changes have certainly lifted the profile of the science-based olympiads in Australia and are increasingly raising the level of interest amongst teachers and potential scholars in the programs. Australia's secondary school teachers have played and continue to play a key role in the success of the science olympiad programs. Without their support and active involvement the achievements to date by the respective team members at the international level would not have been possible. Their many varied roles include identifying gifted and talented scholars, preparing students for the NQE, offering support to the many students that are not offered a place in the annual scholar school or that are overawed by the challenging nature of the NQE, providing tuition for those students that are invited to the scholar school, post-scholar school tuition and further tuition and support for those students that are selected to represent Australia each year at the IChO. It is vitally important that this involvement be nurtured.

There can be no doubt that such an intensive and highly successful academic undertaking as the scholar school chemistry program would not be possible without the support of a university chemistry department and, in terms of the Australian experience, the dedication of a group of immensely talented and totally committed undergraduate, and occasionally postgraduate, students. Each year a group of some six such students, typically past participants at an IChO event, come to the

Department of Chemistry at the ANU (since 1998) to mentor at the scholar school, a role at which they are exceedingly successful. Australia's proud record at the IChO is testament to that. These highly talented students perform much of the laboratory demonstrating, tutoring and lecturing duties in the national program. Currently more than 75% of the lectures are given by ex-Olympians! The latter represents a significant strategic change but one that was nevertheless earmarked as highly desirable early in the development of the program.

The program provides a wonderful opportunity not only for gifted secondary school students to compete at the highest level but also for future educators to savour the teaching experience. Furthermore, several of these ex-Olympians have had the opportunity to travel overseas with the team as a mentor and in recent times as the head mentor. To date, six students have been given the opportunity to act in the latter role and all have done so in an exemplary fashion. The development of the leadership skills of this select group of students in this way is seen as another extremely desirable and rewardingly successful outcome of the program.

So what are the student outcomes from this academic pursuit apart from the opportunity to represent their country at the highest level? Clearly the students attain very high levels of theoretical and practical chemical knowledge and develop a deep appreciation of chemistry. Often they pursue a career in chemistry but not necessarily so. Medicine is a popular choice. The Olympiad also teaches students' generic problem solving skills and effective time management skills as well as encouraging them to be self-motivated and to set and attain very high goals. Furthermore, the Olympiad is a team competition and hence teaches students to network. These are undoubtedly important attributes in a whole gamut of pro-

fessional careers as well as other human endeavours. For an ever-increasing number of these Olympians there are also further opportunities in the program to develop their teaching and leadership skills as delineated above.

Can Australia's phenomenal record at the IChO be sustained or even bettered over the next decade? The continually evolving mechanisms in place at the scholar school certainly invite an optimistic viewpoint provided the NQE can continue to successfully attract and select the 'best' scholars. Recent changes in many of the state-based secondary school curricula in chemistry and the perception by some teachers that the NQE in chemistry is becoming increasingly too difficult and out of kilter with the system certainly poses an interesting challenge that will need to be addressed. Through the introduction of the Big Science Competition, continued increasing awareness and better understanding of the program and the purpose of the NQE, and a continuation and furthering of the program's interaction with teachers, will ensure that this challenge is met.

Dr Geoff Salem is the former head of the Department of Chemistry at the Australian National University and until very recently director of the Chemistry Program of the Australian Science Olympiads. He is also a member of the steering committee of the International Chemistry Olympiad. Dr Mark Ellison is the new director of the chemistry program. Mark is the first-year chemistry coordinator at the Australian National University, a former head of science at Radford College in the ACT and until very recently the deputy director of the chemistry program. Special recognition is given to Mr Bob Switzer. Bob has been the laboratory coordinator and much more in the chemistry program since its beginnings in 1987.