



## *Report from the minister of Education, Culture and Science*

As minister of Education, I am extremely pleased that the 34th International Chemistry Olympiad (IChO) will be held in The Netherlands. This is a great honor for Dutch researchers and teachers, and shows that their contribution to the development and transfer of knowledge in the area of chemistry is a significant one.

*“I am very grateful for the opportunity which the 34th IChO offers for demonstrating how exciting and challenging chemistry can be”*

This olympiad is of considerable importance for chemistry education because it offers a good opportunity to demonstrate that chemistry is both a pleasurable and a creative subject. As one of the traditional basic sciences, chemistry has the unfortunate reputation of being a boring subject, one that primarily reflects on the essence of the elements and the materials around us but is not directed toward any practical use. This concept is far too limited. Our society urgently needs chemists for challenging boundaries in many areas. For example, a considerable amount of knowledge is needed for creating future energy supplies, improving health care, and developing new materials - knowledge which will come from chemistry in particular. The decreasing interest in the study of chemistry presents us with the possibility of a future shortage of chemists. For this reason, I am very grateful for the opportunity which the 34th IChO offers for demonstrating how exciting and challenging chemistry can be. I would like to add that teachers throughout the entire country have used a great deal of creativity in composing the questions for this competition. I hope that young people will feel challenged to participate in the olympiad and that, as a result, many of these will decide to study chemistry. Our society needs them.



**Drs. L.M.L.H.A. Hermans,**  
*Minister of Education,  
Culture and Science.*

## *Report from the president of the 34th International Chemistry Olympiad*

It is always difficult to predict the future. When, in 1986, The Netherlands organized the 18th Chemistry Olympiad (IChO) at the University of Leiden, everyone was enthusiastic about it. This olympiad was a great success and yet it would be a long time before the IChO would be held in The Netherlands again. Nevertheless, the IChO and the affiliated National Chemistry Olympiad has become so impressive that the University of Groningen decided to host this event in The Netherlands in 2002.

Having been co-organizer of the 1986 olympiad, I have been given the honor of contributing once more to this event - this time as its president. The University of Groningen is a lively academic institution with an excellent chemistry department. Spearheaded by Jan Apotheker and Professor Jan Teuben, experts from within and from outside the university have come together to form an enthusiastic organizing committee. The Scientific Committee is chaired by Professor Binne Zwanenburg of the Catholic University of Nijmegen and consists of chemists from all universities in The Netherlands. This team is responsible for producing substantial and, of course, surprising assignments for both the practical and the theoretical segments of the olympiad.

*“A competition which will provide stimulating contacts with chemistry and future chemists, as well as a close-up view of Dutch culture and the magnificent Dutch landscape”*

Thanks to the generous financial support from the Ministry of Education, Culture and Science, the chemical industry, and the University of Groningen, the 34th IChO is sure to be as successful as the fine olympiads which have taken place in recent years. As president of this event, I would like to invite students, mentors, and other interested parties to be in Groningen from July 5th to 14th, 2002, for an exhilarating chemistry competition - a competition which will provide stimulating contacts with chemistry and future chemists, as well as a close-up view of Dutch culture and the magnificent Dutch landscape. I look forward to seeing you in Groningen at the 34th International Chemistry Olympiad.



**Drs. W. Davids,**  
*President of the 34th International  
Chemistry Olympiad.*



## Report from the Chairman of the Organizing Committee

The 34th International Chemistry Olympiad will take place in Groningen from the 5th to the 14th of July. At this tournament, secondary school students from sixty countries will compete to determine - by means of both theoretical and practical exams - who is the best at solving tough chemistry assignments. Each participating country will be represented by four students, who have been selected by means of national preliminary rounds.

The special allure of the olympiad is that a few hundred gifted students come together to focus solely on chemistry and to solve some of its complex problems. The olympiad is, for this reason, extremely stimulating for the students, their mentors, and participating chemists. Many of the students involved in this event go on to study chemistry following graduation from secondary school. Some of these talented young people will very likely excel in this discipline.

The International Chemistry Olympiad also provides mentors with an opportunity to compare the best chemistry programs from a variety of countries and to re-assess their own programs in this light. In this respect, the olympiad can serve as a stimulus for the discussion that is now taking place in The Netherlands concerning the content of the chemistry curriculum in secondary education. Above all, we hope that the competition will increase a wider interest in all aspects of chemistry. There is, after all, a great need for chemists.

*“Some of these talented young people will very likely excel in this discipline”*

The competition will be held in the ‘Nijenborgh’, a building situated in the University of Groningen’s Zernike complex. The participating students will reside in Zuidbroek and their mentors will be housed in Eernewoude. The University of Groningen (RUG) and the National Chemistry Olympiad are involved in the organization of the olympiad.

A large portion of the costs for the olympiad, f 2 500 000.-, will be met by government subsidies and a contribution of the University of Groningen. Industries will also be asked to sponsor this event.

I hope that this will prove to be a splendid olympiad and that our guests will thoroughly enjoy their stay in The Netherlands.



**Drs. J.H. Apotheker,**  
Chairman of the Organizing  
Committee, 34th International  
Chemistry Olympiad.



The chemistry and physics departments, University of Groningen

## Report from the Chairman of the Board of Directors, University of Groningen

In July 2002 I will be very proud to welcome more than 60 teams of brilliant chemistry students to the University of Groningen. Coming from the five continents, they will participate in de 34th International Chemistry Olympiad.

*“The students will try to be smarter and faster than their fellow students in solving exciting and intricate chemistry problems”*

Their goal will be similar to those who participate in sporting events: they will try to be smarter and faster than their fellow students in solving exciting and intricate chemistry problems. Just as in any olympic games, they will be here to win - yet most of their joy will come from participating in this memorable scientific event.

The influence of science on society is greater than ever: just think of the ‘information highway’, for example, or of the effects which our growing knowledge of genes will have on medicine or pharmacy. Nevertheless, there is far less respect and love for science than there was in the past. In my opinion, the importance of such an international competition for young chemists is that it demonstrates how much fun science can be.

I am convinced that the organizers of the 34th International Chemistry Olympiad will do an excellent job and I would like to draw this event to everyone’s attention.



**Prof.dr. S.K. Kuipers,**  
Chairman of the Board of  
Directors, University of Groningen.



Windmill in the mist

## The Netherlands? What kind of country is that?

Ask any number of Dutchmen and –women this question, and you’ll get as many different answers.

Ask a **soccer fan**, and he’ll tell you all you’d ever want to know (and possibly more than that) about Holland – home of Johan Cruyff, about the golden ages of Ajax during the 1970’s and 1990’s, about the national team of 1988 with Gullit, Rijkaard and Van Basten. To which he’ll sadly add that it is high time the Dutch learned how to take penalty shots, because another defeat at the World Cup semifinals will be more than this fan’s feeble heart can take.



The Dutch soccer team during the World Cup qualifying match Estland-Holland (2-4) on June 2nd 2001.

Ask a **nature lover**, and he or she’ll wax lyrical over green flowering pastures teeming with meadow birds. He or she will tell you about the Waddenzee, the largest European wetland reserve. Large parts of the sea fall dry during low tide. Because of this dynamism and the abundance of food, the area is extremely rich in plant and animal life. It is a nursery for North Sea fish, and in winter time it provides food for many hundreds of thousands of hungry migratory birds. But nature lovers will also raise their eyes to heaven in despair at rapidly advancing cities that engulf ever larger areas of open space, with traffic flows that turn a bit of peace and quiet into a scarce commodity.

Or ask a **historian**. With a little luck he or she will entertain you with stories of the Dutch Golden Age of the 16th and 17th centuries. The age in which majestic Dutch merchant vessels sailed the seven seas. He will talk about historic figures that left an indelible impression on the Dutch and their country, such as 15th-century humanist Erasmus, known primarily for his Praise of Folly. Or of Christiaan Huygens, who invented the pendulum clock and developed the theory of probability, and who is also known for his contributions to the development of the telescope. Or of Spinoza, the philosopher, and Berlage, famed for his early 20th-century architecture.

Ask a **geographer**, and after trumpeting forth about the unique qualities of Amsterdam, he will inevitably tell you about water, dikes, polders, windmills and how a considerable part of Holland actually lies below sea level. He will also add that if he had been commissioned to plan all this, it would have looked very different and undoubtedly much better.

Ask a **computer artist** what art can tell you about the Dutch. With one hand on a mouse and a joint in the other, she may tell you somewhat wistfully about Rembrandt’s modest but masterful self-portraits that only just manage to lift a corner of the veil over the Dutch soul. In another way, this also goes for Van Gogh’s expressionistic brush technique, for the systematic road to abstraction that Mondriaan took, and for Escher’s inimitable metamorphoses.

Or ask **any passer-by** about the Dutch weather. They will invariably complain. The summer is too wet and too cold, the fall is too wet and too windy, the winter is too wet and too warm and the spring is too wet and too late. But if the sun is in a good enough mood to peek out from behind the clouds, their faces will brighten up immediately. One will praise the ever-changing beauty of Dutch cloudscapes, the other will boast about the vibrant colors of a park lit by the watery sun on a September evening. Yet another will daydream over memories of a pond in the winter, newly frozen-over.



The Dutch flag



Beatrix, Queen of the Netherlands

And of course, ask a **chemical scientist** about The Netherlands. If you happen to meet one with a sense of history, he'll mention the names of the three Dutch scientists that won the Nobel Prize in the previous century. The first Dutchman ever to win the Nobel Prize was a chemist, Jacobus van 't Hoff, who received this most prestigious of accolades in 1901 for his work on chemical equilibria and osmosis. In 1936 it was Petrus Debye's turn for his research into the interaction between radiation and matter. Recently, in 1995, Paul Crutzen was awarded the Nobel Prize for his research into the hole in the ozone layer. That same chemical scientist might also tell you about the important part the (petro)chemical industry has played in rebuilding The Netherlands after the Second World War. He will tell you about large multinationals such as DSM, AKZO-Nobel and Shell.

**The Netherlands? What kind of country is that?** You'll note that this is not an easy question to answer. There are so many other stories that you will hear or may have heard. That is why it may be worth your while to read some more about Holland, before you go. And please, do try to look beyond wooden shoes, tulips and cheese. It will make your journey so much more interesting.



Polypropylene storage facilities at the DSM-site Geleen

## A landscape with a fascinating history

Rapeseed fields in the Province of in Groningen



Walking on the mud flats of the Waddenzee



The Grand Terp

"If the sea level rises, the people of Groningen will survive", according to British filmmaker and artist Peter Greenaway, known primarily for his movies which include gems as *The Cook, The Thief, His Wife and Her Lover*. Last summer, he built an artificial *wierde* in honor of the Groningers. He constructed this mound of mud, sand and clay near the city of Groningen, host of the 34th International Chemistry Olympiad in 2002. The 12 yard-high Grand Terp measures 230 ft across. This work of art is a symbolic representation of how the inhabitants of the northern provinces, the Groningers and the Frisians, have waged war against the sea for over 2000 years.

### Floods

This battle has left many visible traces. Apart from hundreds of *wierden*, this fascinating history is still very much alive in old as well as newer dikes, meandering waterways and winding roads. The first inhabitants appeared as early as 600 B.C. on the wetlands along the shores of the Waddenzee, the shallow waters at the edge of the North Sea. They lived on the banks of the rivers that flow northward, where they bred cattle, hunted for fish and planted crops. During the first few centuries there was little need for protection against the sea, but from the second century B.C., things started to change for the worse. To their horror, the inhabitants noticed that the sea level began

to rise, and floods increased in number as well as in size. Many people fled the area. But those who dared to stay, sought higher ground – they constructed mounds of clay, sods, manure and garbage, on which they managed to survive the floods. Through the ages, the mounds became higher. The highest *wierde* reaches 5,5 yards above sea level. They also became bigger, to a size of about 820 ft across. Entire villages were built on the *wierden*. In the early Middle Ages, the first churches appeared on these home-made hills. Surprisingly, dikes did not appear until about 1100 A.D. They protected small areas against the sea, but they often burst during storm floods.



## The city of Groningen

The ancient city of Groningen is bustling with life. For over a thousand years, the city has been the single most important center of activity for miles around, which is clearly noticeable in many of the inner-city buildings. Also, Groningen has always provided a good home to students. No less than 35,000 out of Groningen's 180,000 inhabitants are students at the university and other institutions for higher education. Sample the inner city's street life, and you'll know. Taste the youth culture and night life in one hundred and sixty bars and restaurants, fifteen movie theaters, seven theaters, a casino and a music center. Lovers of fine arts should not miss out on the opportunity to visit one of the city's museums, the highlight being the internationally renowned Groninger Museum designed by Alessandro Mendini. This museum, spectacularly situated in the canal surrounding the inner city, regularly boasts controversial modern art exhibitions. Part of the museum is dedicated to the historical and cultural development of the city and the province, as evidenced by archeological artifacts that were unearthed from the Groninger *wierden*.

### Groningen University

The university was founded in 1614 by Ubbo Emmius, a traveling scientist. This was not the only university he managed to set up – he also founded one in Göttingen. Apparently he was not an easy person to get along with, because he got himself thrown out of several cities. The university has flourished, and has gained a world-wide reputation for excellence in several fields. The institution is especially renowned for its contributions to the exact sciences, not in the least through the efforts of scientists like Frits Zernike - yet another Nobel Prize winner from Groningen – and more recently thanks to the development of the chemical motor by Ben Feringa's group. You will read more about this in upcoming issues of *Catalyser*.



The Groninger Museum



The Martini-tower in Groningen

### Monks

Monks have had a significant influence on the evolution of the landscape. From the twelfth century onwards, they founded dozens of monasteries in the northern coastal areas. They also built dikes, polders and waterways. They ventured to construct locks, in order to control the water level inland and to keep the sea out. This made it possible for the farmers to build their farms on the lower grounds around the *wierden*, as they still do today. The only difference is that today's dikes are high enough to withstand even the severest of storms. The monasteries did not hold so well. Once about 120 monasteries dotted the landscape in the Frisian coastal areas. Now, all that is left are a few bits and pieces. But if you drive along the narrow roads between the pastures, you can always see several churches on the horizon, whichever way you look – they all stood the test of time. And there they always will be, sitting peacefully on top of their *wierden*, as old as time itself.



The main university building, University of Groningen

## Friday July 5th

- Arrival of students, mentors and guests.
- Welcome reception and dinner in the main university building ('Academie Gebouw').

## Saturday July 6th

- Official opening in the Martinikerk.
- Jury meeting 1:  
Determine practical assignments.
- Excursions, including a walk around Groningen.

## Sunday July 7th

- Excursions.

## Monday July 8th

- Practical exams.
- Activities for students at the university sports center.
- Boat excursion for mentors and guests.

## Tuesday July 9th

- Jury meeting 2:  
Determine theory assignments.
- Excursion for students: 'Water Management and Chemistry'.
- Excursion to Makkum for guests.
- Frisian evening for mentors and guests.

## Wednesday July 10th

- Theory exams.
- Excursion to Amsterdam, Marken and Volendam for mentors and guests.
- Boat excursion for students; evening out in Groningen.

## Thursday July 11th

- Assessment of theory and practical exams.
- Jury meeting 3.
- Excursions, including 'Skûtsjesilen'.

## Friday July 12th

- Comparison of marks and determination of points.
- Jury meeting 4.
- Excursion to Amsterdam, Marken and Volendam for students.

## Saturday July 13th

- Shopping in Groningen.
- Closing ceremony.
- Closing dinner and party.



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Cultuur en Wetenschappen



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## *Van 't Hoff: First ever Nobel Prize in Chemistry winner*

For the Netherlands, Chemistry 2001 was a special year, the 'Van 't Hoff-year'. More than a hundred years ago, in 1901, the first ever Nobel Prize for Chemistry was awarded to the Dutch physical chemist Jacobus Henricus Van 't Hoff. Van 't Hoff earned the Nobel prize for 'the discovery of the laws of chemical dynamics and osmotic pressure in solution', as the jury put it. The prize was not awarded for his description of the asymmetrical carbon atom, in itself worthy of a Nobel prize.

In 1901, Van 't Hoff was only 49 years old, but he already had a marvelous career behind him. In 1892 he became a member of the Royal Prussian Academy of Sciences, in 1893 he was awarded the Davy medal by the English Royal Society, and in 1894 he was named a 'Chevalier de la Légion d'Honneur' by France. Recently, he has been numbered among the 80 founders of chemistry. Starting from his ideas about the tetrahedral structure of carbon compounds, he moved on to chemical kinetics, osmotic pressure and geochemistry. Throughout the years he had to defend his ideas about stereochemistry and diluted solutions to the established chemists.

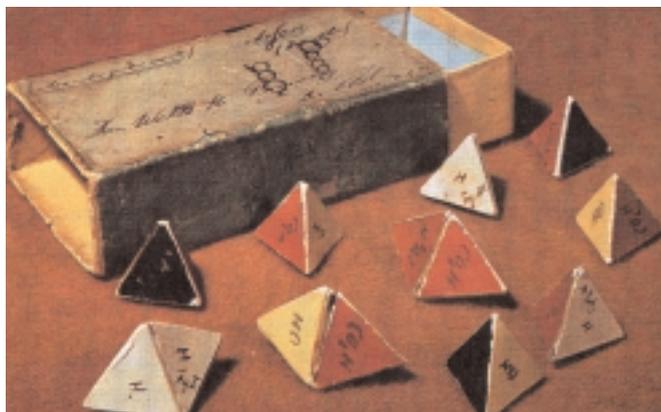
Van 't Hoff was born on August 30, 1852. In high school he developed his lifelong passion for chemistry. In 1869 he went to the Polytechnic School in Delft to study chemical technology. Two years later, after having gained his diploma at breakneck speed, he continued his studies in Leyden, focusing on mathematics and theoretical chemistry. Van 't Hoff wrote his thesis, entitled 'Contribution to the knowledge of cyanoacetic acid and malonic Acid' at the age of 22, in which he proposed the tetrahedral structure of carbon compounds.

*Visit the website:*

[www.chem.rug.nl/icho34](http://www.chem.rug.nl/icho34)

It would later be called 'a product of childish fantasy' by the German professor Herman Kolbe despite the fact that it was the perfect explanation for Pasteur's experiments with tartaric acid. After working as a private teacher, as a lecturer at the Veterinary College

See next page >>



Models of the tetrahedral structure of carbon compounds made by Van 't Hoff in 1875 for a friend.

## *Happy to present Catalyzer 2*

The team organizing the Olympiad is becoming more and more excited as the date of the Olympiad draws closer. We are eagerly looking forward to your arrival in Groningen. We would like to extend a particularly warm welcome to Egypt, Iceland and Turkmenistan, who are participating with official teams for the first time.

This mailing is being sent to you along with the preparatory problems. By the time you receive it, the preparatory problems will have appeared on the web site. Please note that only the numerical answers are listed on the web site. The worked solutions are included in the hard copy. This means that you will have control over the distribution of the worked solutions to the problems to your students.

A number of delegates will have to apply for visas via the Dutch Embassy in their home country. We have done everything possible to facilitate the process for obtaining visas. Please note that it will take about 4 weeks to get a visa as a result of the Schengen treaty. The microscale sets that will be used during the Olympiad can be obtained from Kimble-Kontes, see: <http://www.kimble-kontes.com/html/pg-748000-Microscale.html>. Binne Zwanenburg, chair of the academic committee, has assured me that the practical problems can also be performed with ordinary glassware. This is explained in more detail in the prep. tasks.



I would also like to wish you all the very best for the year 2002, and I look forward to welcoming you to Groningen in July.

**Jan Apotheker,**

*Chair of the organizing committee for the 34th International Chemistry Olympiad*



## Impressions of Mumbai

From 6-15 July 2001, host country India organized the 33rd International Chemistry Olympiad in Mumbai. The winners of the tournament came from China, Russia and Argentina. Although the Dutch team only managed to win a single bronze medal, the Olympiad was an unforgettable experience for them. The amazing impression made by the host country played a not inconsiderable part in this.

'Mumbai can't be compared with any other city I've ever visited,' says Jan Apotheker, the organizer of the International Chemistry Olympiad 2002 in the Netherlands. 'So many people, so much bustle in such a small place, unpaved, narrow streets, small stores and food stalls everywhere. Even when



Traffic in Mumbai

there was half a meter of water in the streets from the monsoon rains, life just carried on regardless. The Indians just quietly waded through it. I also noticed how colorful and tidily everyone was dressed despite everything.' The Mumbai traffic is also etched into the memories of the Dutch delegation. 'Everything was honking its horn and making a noise',

remembers delegate Maaïke van den Heuvel. 'It's amazing that we only crashed into a cab once.' In addition to life on the streets, contacts with the Indians and participants from other countries also made an impression. 'When I think back on India, our fantastic guide always springs to mind', says Van den Heuvel. 'She was a wonderful person, called Pooja. She fitted

## >> Van 't Hoff

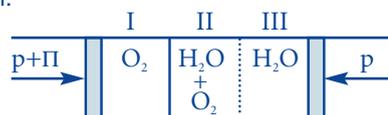


Van 't Hoff at the age of 20

in Utrecht and as a lecturer at the University of Amsterdam, in 1878 he was appointed Professor of Chemistry, Mineralogy and Geology. His inaugural address was entitled 'The power of imagination in Science'. The work he did in Amsterdam on equilibria finally led to him being awarded the Nobel Prize. The laboratory in which he carried out his work is named after him and is now a museum. Many students attended Amsterdam

University to be taught by Van 't Hoff but, according to the famous professor himself, a great deal of his time was wasted in teaching instead of his beloved research. In 1896, Max Planck invited him to go to Berlin as an Honorary Professor, giving him the opportunity to work without any teaching obligations. In spite of vigorous efforts by the city council of Amsterdam and the Ministry of Education to persuade him to stay, Van 't Hoff moved to Berlin. Through all of Van 't Hoff's work, one theme keeps recurring, that of affinity. In stereochemistry, four atoms are attracted to a central carbon atom. With this in his mind, he described the way molecules react with each other. In his concept of chemical equilibrium, attraction and repulsion play important roles. He also applied this to the attraction between liquid and dissolved material, which logically led to the theory of osmotic pressure. Finally, Van 't Hoff formulated a theory about salt deposits. Here, affinity determines the most stable formation. We can certainly be sure of one thing, subsequent chemists, right down to the

present day, still have an affinity with the ideas of Van 't Hoff, not only his theoretical innovations, but also his imagination.



### Van 't Hoff's Law

Van 't Hoff is known all over the world because of Van 't Hoff's Equation. The origin of this equation is a description of a three-compartment system, as illustrated in the figure. Pressure  $p$  is being exerted on the left-hand piston and pressure  $p$  is also being exerted on the right-hand one. Compartment II contains a gas which is hard to dissolve in a liquid. Oxygen dissolved in water is a good example of this. The pressure in compartments I and II is  $p+\Pi$ . A semi-permeable membrane separates compartments II and III; water is able to flow freely through the membrane but not oxygen. Van 't Hoff wondered whether 'the diluted gas in I acts according to the Boyle-Gay Lussac's Law, in compartments II and III Henry's Law can be applied (that states that the gas pressure in I is proportional to the concentration of gas in II). How can the osmotic pressure be related to the elastic pressure in I, depending on the amount of gas in the several compartments? Changing the volume of one of the compartments I or II directly influences the volume of the other, according to Henry's Law. Thus it can be demonstrated that the osmotic pressure of the solution is identical to the elastic pressure of the gas, in this case the concentration of the gas is equal in both compartments.' Van 't Hoff concluded that the osmotic pressure can be described by the following formula  $\Pi=iRTx$ , where  $x$  is the molarity,  $i$  is the so-called Van 't Hoff factor of the gas,  $R$  is the gas constant and  $T$  is the temperature. This formula is now known as the Van 't Hoff equation.



## Dear Friends and Colleagues,

It is a privilege and a great pleasure to welcome you to the 34th International Chemistry Olympiad.

After fifteen years we are very glad to organize this prestigious event once again in the Netherlands. It is the University of Groningen that took the initiative.

We set up a team of enthusiastic organizers and a scientific committee with well known chemists from all Dutch universities. Together with a strong financial support from the Government and our chemical industry we are well prepared to work on every detail of 'our' IChO in July 2002.

More than a hundred years after the first Nobel Prize for chemistry for the Dutch chemist Van 't Hoff we have a strongly developed chemical science and chemical industry. Groningen is an interesting north pole of this chemistry.

We are sure that we can make the 34th IChO especially memorable at the chemical as well as at the social and cultural level.

Looking forward seeing you all in the Netherlands, Groningen summer 2002.



With best wishes,

**Wout Davids**  
President of the  
34th IChO

perfectly into our team. We are all rather creative, or at least that's what we think, with the result that we are always drawing strange figures, portraits of each other. Pooja was just as mad and drew along with us. To top it off, she was an incredibly nice person. She even got up specially at 6 o'clock one morning, just to wish us luck.' The winner of the bronze medal, Daan Brinks, also fondly remembers the people he met in Mumbai. 'National Olympiads are great for making contacts but it's even better when you are standing talking in broken English during an international Olympiad with people from three different countries and you have the feeling that they know what you're talking about. And then our team is usually great fun. Despite the fact that we all were ill at some point, the Olympiad was a roaring success as far as I'm concerned.'

### Conceptual ideas

Jan Apotheker is very positive about the organization of the 33rd International Chemistry Olympiad. 'In the brief time that the host country had to organize it, they managed to achieve an incredible amount. It looked very good. The atmosphere was very positive, quiet, and amiable.' As a

didactician, Apotheker was also pleased with the problems set for the students. 'I was particularly impressed with the fact that conceptual ideas were also included in the problems. For example, one of the questions was about the hydrogen atom, consisting of a nucleus, a proton and an electron orbiting the nucleus. What happens when you replace that electron by a muon, a particle with the same charge but a different mass. You can only answer this question if you really understand the concept of an atom. The really brilliant people are particularly good at dealing with this kind of questions.' Jan Apotheker soaked up everything he saw in India. What did he learn for the Olympiad in Groningen? 'They had organized their computer room particularly well. I also noticed that at a certain moment you need to have a computer printout of the final problems. Everyone could get hold of them via the Internet, but that kind of printout is more important than I'd thought. I also learned that it is important to plan in enough breaks. Even as a supervisor you hardly have a moment's peace. You only sleep four hours a night. All in all, Olympiads are hard work.'

### Results ICHO 33 Mumbai, India

#### Top Three (scores out of 100)

- 1 Siyuan Chen(China), score: 92,31
- 2 Iouri Chliapnikov (Russian Federation), score: 91,51
- 3 Esteban Andres Ganc (Argentina), score: 90,20

#### Special Prizes

*Best Overall Performance*  
Siyuan Chen (China), score: 92,31

*Best Performance among  
Female Participants*

Shadi Rajabi (Iran), score: 90,18

## Lessons in Dutch

### Part 1

- Hello, how are you?
- I'm all right thank you.
- Thank you.
- Please.
- It's cold, isn't it?
- Good morning.
- Good night.
- Good luck!
- How much is that in euros?
- Are you going to the party tonight?
- Please may I have a cup of coffee/a cup of tea/ a beer/a glass of wine?
- Hallo, hoe gaat het?
- Met mij gaat het goed, dank je.
- Dankjewel.
- Alsjeblieft.
- Koud hè?
- Goeiemorgen!
- Welterusten.
- Veel succes!
- Hoeveel Euro kost dat?
- Ga je vanavond naar het feest?
- Mag ik een kopje koffie/ kop thee/pilsje/ glaasje wijn?



## Practical Information

### Participation and Registration

All registration forms have been sent out to the head mentors before Christmas.

You will also find a copy of them on the official website of the 34th IChO. The country registration form and the payment form must be returned to us by **February 1, 2002**, the mentors', observers' and guests' registration forms by **March 1**, while the students' registration forms and travel details can wait until **May 15, 2002**. Payments should be made by **March 1, 2002**.

A **Delegation** consists of six participants: two mentors and four competitors (students). Accommodation, meals and programs for the two mentors and 4 students are provided by the organizers. A delegation may be extended to 7 by a scientific observer. The scientific observer and any accompanying guests must pay a registration fee of US\$ 1500.

**Mentors** should be experienced and trusted advisors with a good command of the English language. They must be able to translate the examination papers from the English version into their pupils language and to participate in the discussions of the International Jury.

A **Scientific Observer** is a person who is participating for a competing delegation in order to gather experience to become a mentor in future olympiads. The scientific observer, therefore, is allowed to participate in translating the examinations and to attend the meetings of the International Jury. A scientific observer can also be an official delegate from a country, that is planning to participate in the olympiad in the coming years. Each observing country is allowed to send one observer, who will enjoy the same privileges as the scientific observer. The registration fee for him/her is also US\$ 1500.

**Students** are the competitors. They must not be enrolled in university, and they can only be enrolled as students in secondary schools not specialized in chemistry. If they have already graduated from secondary school the organisation must be informed about the month and the year of their graduation. (See the students' registration form). Furthermore, students must be under the age of 20 at July 1, 2002. The age of the participants will be checked in their **passports** at registration.

**Guests** are persons not allowed to participate in any formal activities of the International Jury. Their registration fee is US\$ 1500, which covers accommodation, meals and a guest program.

**Registration Fee.** This standard registration fee covers a full delegation of four students and two mentors. This is a standard fee, and no discount will be given to smaller delegations.

$$\text{Participation fee} = 100 * N \text{ US\$}$$

(N = number of years of participating or number of years elapsed since being a host of an IChO)

Apart from that a registration fee of US\$ 1500 will be charged for every person accompanying the official delegation. See the payment form.

**Health Insurances** Participants, mentors, observers and guests are obliged to have a health insurance. When you register at the IChO-Secretariat we will check that your delegation is sufficiently insured. If you are not insured you will not be admissible to the Olympiad. Please remember to bring the necessary documentation.

The organizers will arrange for accident insurance for all participants in connection with the organized program. They will also be provided with a public liability insurance (third party insurance).

**Academic conduct** During the opening session we will ask one of the students to pledge a code of academic conduct on behalf of all the participants:

- On behalf of all participants I solemnly pledge*
- *To uphold the Code of Academic Conduct which establishes and provides a system in which high standards of integrity, fairness, equal opportunity, and professionalism in the conduct of academic pursuits.*
  - *To participate in this event in an honorable and fair fashion in accordance with the code of academic conduct.*
  - *To uphold the regulations of the International Chemistry Olympiad.*

**Communication Devices** These include mobile phones, laptop computers with communication devices, palm-size computers etc. Neither students nor mentors nor any of the observers are allowed to have access to or to attempt to have access to such communication devices. This means that you must deposit all your communication devices from Saturday afternoon to Wednesday evening and that the phone lines in and out of your hotels will be disconnected during the same period.

**Computers and Software** The computers to be used during the translation period will have an international version of Windows 2000 and Office installed. It will not be possible for us to supply all the different delegations with keyboards matching their specific languages, but you are allowed to bring your own keyboards and laptop computers for use during the translation period (provided they are approved by the organizers). If you need to install your own software, we would like to know in advance. In that case please indicate this on the Mentors' registration form, and send the necessary software **two months before the olympiad** to us.

**Calculators** for the examinations will be provided by the organizers (TI-83+). No other aids are allowed.

The **Preparatory Problems** are being sent to you with this issue of Catalyzer. They are also available on the official website of the 34th IChO.

# Travel and Accommodation

## Visa and Immigration

When travelling to the Netherlands citizens of a number of countries need to apply for a visa for a short stay. You can apply for a visa at any Dutch embassy or consulate.

We have included information about visa in the mail sent to the head of the delegation. This information will also be available as a PDF-file on the website.

## Arrival in the Netherlands

When you arrive on Friday, July 5, at Schiphol International Airport Amsterdam, you will be met at the airport. A guide will accompany you to Groningen Central Station. From there you will be transferred to the university building ("Academie Gebouw").

## Early Arrival and Late Departure

If your delegation arrives before July 5, or leaves later than July 14, we are able to help you with accommodation before and after the olympiad. Please indicate on the Travel details form how many nights and how many rooms you will need. Notice that we will only provide transportation from/to the airport or Groningen Central Station on July 5 and 14. However, it is very easy to travel by train from Schiphol Airport to Groningen.

## Accommodation and Meals

Students will be staying at the Van der Valk Motel-Zuidbroek, and mentors, observers and guests will be staying most of the week at 'It Wiid'-Eernewoude and a few days at hotels in Groningen. *Further information follows in Catalyzer 3.* If you have any special dietary needs, we would like you to specify these in the different registration forms.

## The IChO-Secretariat

The secretariat will be located at the University Groningen, location Zernike, Nijenborgh 4 – 9747 AG – Groningen, the Netherlands. Phone +31-50-363 4615. Fax +31-50-363 4500.

## Communication

Telephone calls from the Netherlands can be made from pay phones using either coins, special telephone cards (which can be bought in convenience stores) or credit cards. In case

of an emergency, call 112 from any phone (no payment required).

# General Information about the Netherlands

The **Official Language** in the Netherlands is Dutch. However, you will find that most people speak English and are usually quite willing to help you.

## Currency and Banking

The currency in the Netherlands is the Euro (€). It is available in denominations of 500, 200, 100, 50, 20, 10 and 5 €. Coins of 1, 2, 5, 10, 20 and 50 Eurocent, 1 and 2 €.

10 € is equivalent to approximately US\$ 10,80. Traveller's Cheques can be cashed in any bank where you can also exchange foreign currency. Banks are usually open Monday through Friday from 10 am to 4 pm. The easiest way to obtain cash, is by using your bank or credit card such as Visa or Mastercard. You can also use cash machines outside of the opening hours.

## Climate

The olympiad takes place in the middle of the Dutch summer. It is difficult to predict the type of weather however. It may rain, with temperatures around 15 degrees Celsius, or even lower. On the other hand we may have a heatwave with temperatures way up in the 30s. As a rule it is often pleasant and sunny with temperatures around 21 °C.

## How to dress

Dressing is very relaxed in the Netherlands, and you can usually dress the way you like best. The students must remember to bring running/training shoes and a swim-suit. The opening and closing sessions are formal affairs in which more or less formal clothing is desirable.

## Medical services

There are no health problems in the Netherlands. No special measures are needed. If medical care should be needed during the olympiad you can ask for help at the hotel lobby. Medical care will then be provided.

## What's on today's menu?

### Kale stew with Polish sausage and bacon

During winter, when the blizzard is howling outside and snow is piling up, this dish is served in Holland.

#### Ingredients (4 servings)

- 2 lbs potatoes
- 1 lbs kale (stripped, without the hard nerves)
- 8 ounces bacon (not to lean)
- selection of Polish and Frankfurter sausages
- If you prefer a vegetarian variety you can choose tofu
- cup milk
- cup vinegar
- 1 onion
- salt, pepper, brothcube

#### Preparation

Peel the potatoes, wash them and cut them in inch sized cubes. Boil the potatoes in a closed pan with a little water until done (20 minutes).

Wash the kale. Put it in a large pan, with the sausages and a little water. Bring to boil and simmer for about 20 minutes.

Cut up the bacon and fry in its own fat until crisp.

Drain the potatoes, add the milk and crush the potatoes to a not to fine puree.

Stir in the kale, bacon and bacondrippings.

Bring to taste with salt and pepper.

Serve with the sausages, the vinegar, the shredded onion and some pickles.

Enjoy!!!!!!!!!!



## Spedacular Holland tour

Whilst in Europe and Groningen combine your stay with a few days in Holland, or a combination of Holland and Belgium, before or after the 34th Chemistry Olympiad. The organisers of the 34th Chemistry Olympiad have made arrangements with the Destination Management Company **Amstour Holland** in Amsterdam, who are specialists in creating wonderful tours through Europe.

Besides the fact that more arrangements are possible, you will find below a short description of one example:

*The Spectacular tour of Holland in 2 days:*

**Day 1) Monday** – After leaving Amsterdam, a full day's drive around the southern part of the IJsselmeer (former Zuiderzee) with its dreamy 16th century old cities and fishing villages. A stop at the Zaanse Schans Open Air Museum, with windmills still in operation. Via Edam and Hoorn our coaches takes you to Enkhuizen where you visit the Zuiderzee museum, a splendidly reconstructed old Zuiderzee village. Along the dike right across the IJsselmeer to Lelystad and along the old Hanseatic town Harderwijk. For dinner we take you to Arnhem-Oosterbeek and over-night at the hotel De Bilderberg or similar.

**Day 2) Tuesday** – This day begins with a visit to the National Park De Hoge Veluwe, with the Kröller Müller Museum, well known for its Van Gogh collection and sculpture park. Along to Gouda, known for its cheese, candles and pipes. Here a visit will be made to the St. Jans church. Then to the Hague for a tour around this Royal City, home of the Queen and seat of the Dutch Government. Your tour terminates on Tuesday upon arrival in Amsterdam. (estimated time 18.30h.)

### Departures and prices:

Collection: Passengers will be collected from Hotel Sofitel Amsterdam at 08.00h on Mondays. Departures every Monday are guaranteed!

### Prices:

- 2 days, twin room from € 272,00 per person
- 2 days, single room from € 306,00 per person
- 2 days, triple room from € 266,00 per person

including accommodation in a first class or superior tourist class hotel, breakfast and dinner, multi-lingual tourguide and entrance fees.

Due to the fact that departures and arrivals are from/in Amsterdam, we strongly advice you to arrange a pré or post night in Amsterdam.

Please direct all your requests, also for alternative toursuggestions and pré & post nights to:

### Amstour Holland

Stromarkt 5

1013 SW Amsterdam

the Netherlands

Tel.: +31 20 530 4430 Fax: +31 20 427 7665

E-mail: [book@amstour.com](mailto:book@amstour.com)

## Company profile AVEBE

AVEBE plays a major role in the global sales, marketing, production, and development of starch and starch specialities used in food-stuffs, pharmaceuticals, animal feed, textiles, paper, and adhesives. AVEBE is determined to maintain and further expand its worldwide market leadership in the area of potato starch and potato starch specialities.

AVEBE's strength lies in its capacity to supply the processes, products, and technical requirements its clients need. AVEBE puts this know-how, together with its advanced technology, effective service, and comprehensive technical support at its clients' disposal. The continual drive for innovative progress has made AVEBE a leading and distinctive company in starch specialities.

AVEBE's international sales and distribution network forms the vital link between professional, industrial clients and AVEBE's divisions and regions in Europe, the Middle East, North and South America, and South East Asia.

An international cooperative, AVEBE brings the concept of integrated chain management to life by directly guiding its members and suppliers. AVEBE creatively offers unique possibilities for renewable resources to make better foodstuffs and industrial applications.

*AVEBE b.a., P.O. Box 15, 9640 AA Veendam*



The release of the Catalyzer is made possible by the sponsorship of AVEBE.



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34<sup>th</sup> International  
**CHEMISTRY OLYMPIAD**

Groningen | The Netherlands | 5 - 14 July 2002

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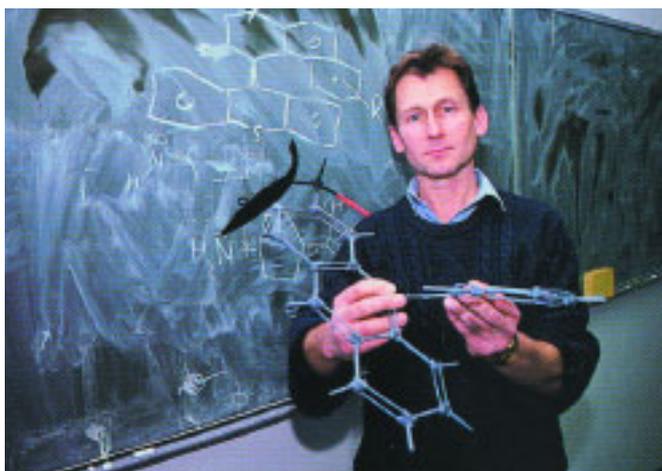
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Graphic design  
G2K designers, Groningen/Amsterdam



## Groningen Chemists Develop a Molecular Motor

A Dutch-Japanese team headed by Groningen chemist Ben Feringa has developed a motor operating at the molecular level. It is fueled by light energy. The creation of the nanomotor is a recent step in the rapidly developing field of nanotechnology, chemistry on the smallest possible scale.

The interest in nanotechnology has its origins in the world of computers, where researchers are constantly trying to downscale components. And if you are working on an ever-decreasing scale, you will ultimately end up at the level of the individual molecule: the nanometer level (10<sup>-9</sup> m, a billionth part of a meter). In recent years, we have seen that this unimaginably small world harbors unlimited possibilities. Countless products have been unveiled by the laboratories, including nanotubes, nano-switches, nanopendulums, nano turnstiles, and nano gearwheels. There is even talk of nano trains. Gradually, the molecular toolkit is filling up with components that future engineers will use to build their machines.



Professor Feringa, with a model of the molecular motor.

In 1999, Groningen professor Ben Feringa added an essential component to this smallest of all building kits. In a Nature article co-authored with his Dutch and Japanese colleagues, Feringa described the creation of

[See next page >>](#)

## Dear Participants,

Everything is being made ready for your arrival in July. We hope that this will be an inspirational Olympiad, particularly for Chemistry education which is having a hard time in the Netherlands. Fewer and fewer students seem willing to enroll as Chemistry students. We hope that the IChO will show how much fun chemistry can be.

Catalyzer 3 will bring you up to date with the program for the 34th International Chemistry Olympiad. So far, there are 58 participating countries sending 232 students to the exams in Groningen. New countries include Turkmenistan, Egypt, and Iceland. We welcome them to the IChO community. Apart from the participating countries, there will be a number of observing countries. Albania, Mongolia, Portugal, and Nigeria also sent observers last year. New are Japan, Ivory Coast, and Kenya. We hope that Yugoslavia will also be able to send observers to the Groningen Olympiad. We will soon put the registration information on the website so that you can check if it is correct.

The scientific committee is working on the last details of the exams to be taken. Final checks are being conducted to ensure that the experiments will work flawlessly. It is crucial that the grading of the participants be fair and unambiguous.

As you know, the Netherlands is a rather wet sort of place. I hope you haven't forgotten the swimming lessons you took way back, as mentors and guests will be housed on an island. You will find details of the places you will be staying on pages 4 and 5 of this Catalyzer. A swimsuit is an absolute necessity as you will have ample opportunity for swimming, sailing, canoeing, and similar activities.

I would like to wish everyone all the best with the organization of the preliminary rounds in your respective countries, and wish you a pleasant journey to Groningen. We are preparing a warm welcome for you!



**Jan Apotheker**  
organization chair

## Introducing Some of the Members of the Team Organizing the 34th IChO



First of all, here is Prof. Binne Zwanenburg, chair of the scientific committee, seen here at a meeting with the organizers.



Then there is Ok Hoelscher, the assistant of the chair of the Olympiad. He knows everything there is to know about it.



Greetje Lap is the IChO secretary; she is always on the job. A number of you have already been in touch with her.

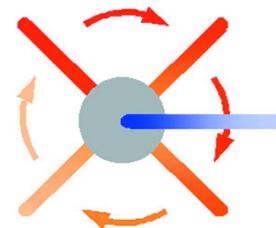
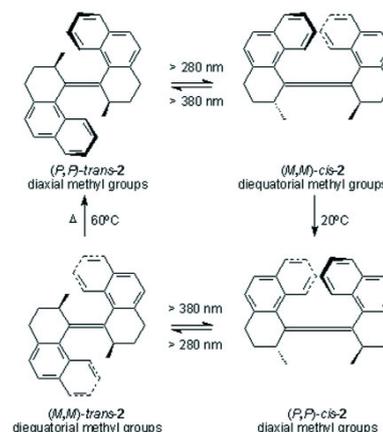
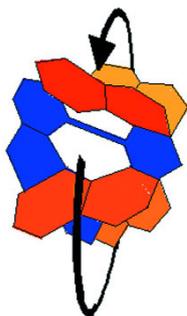


The last person we would like to bring to your attention is Dr Willem van der Veer, who coordinates the organization of the exams.

### >> Molecular motor

the nanomotor, that consists of only a single molecule.

According to the definition, a motor is a device that absorbs energy and converts it into motion. And that is exactly what the nanomotor does. Feringa states that there should be "controlled rotation," for which there are two basic criteria: "The first requirement is the use of energy, so that you can control the motor by regulating the fuel supply. The second condition is that the motor can operate in a particular direction, because it will not be useful for practical propulsion if you never know whether it will operate in forward or reverse gear when you turn it on."



#### Four steps

The molecule developed by Feringa's group has two identical parts connected by a double carbon strip that acts as an axle. Each half consists of three rings of six carbon atoms with a methyl group in the outermost ring. In all, the molecular motor consists of no more than 58 atoms. "We have made this organic molecule with ordinary methods for chemical synthesis," the professor explains. Rotation occurs in four discrete steps. The first step is a 180° tilt in which the molecule — in chemical terms — switches from a trans to a cis configuration. This means that the two halves of the molecule change from a position where they are far removed from each other to one where they are approximately perpendicular to each other. This step requires energy in the form of ultraviolet light. The configuration resulting from this first step is energetically less stable because it brings the two methyl groups into an unfavorable position. This will cause the turning half to turn even further. This second step is irreversible at 208 °C. After the first step, the molecule can still turn in the reverse direction; this is no longer possible after the second step. In the third step, the molecule continues to rotate. This again requires light energy. After the fourth and last step, the

molecule returns to its original state. This step, that — like the second step — can only proceed in one direction, requires heating the molecule to 60 °C.

#### Blood vessels

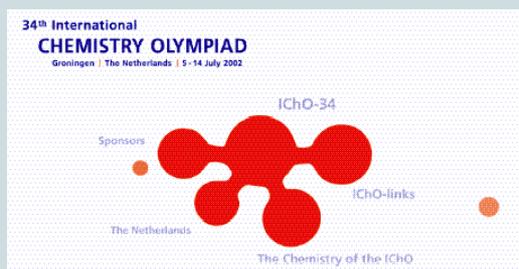
At present, the molecular motors are not rotating very fast — Ferrari has not shown any interest yet. An entire revolution, under close supervision, takes no less than seventy minutes. "It is a primitive system whose underlying principle has only recently been demonstrated," says Feringa. "But now that we know how it works, we can modify the molecular motor in such a way that it will rotate much faster."

It is hard to say what you can do with nanomotors because the development is simply too new. However, there have already been speculations about small motor-driven robots traveling through our blood vessels to repair damaged body tissues. They could also possibly be deployed to clean up toxic waste and convert waste materials into useful raw materials. And perhaps nanomotors will one day contribute to the development of computers that are even smaller and faster than today's; who can tell? Feringa puts things into perspective: "People should realize that this is fundamental research. It may take as long as thirty to fifty years before we see any practical applications."

Visit the website:  
[www.chem.rug.nl/icho34](http://www.chem.rug.nl/icho34)

## The Internet Site of the 34th International Chemistry Olympiad

Like any well-organized event these days, the 34th International Chemistry Olympiad (IChO) has its own website. It not only contains information about the IChO itself, but also provides interesting information about the Netherlands, the city and province of Groningen, and the University. Of course, the website is the place to visit for registration forms and interesting links, for instance to previous host countries. Moreover, this site will always contain a PDF version of the latest issue of *Catalyzer*, the magazine that is an absolute must as a source of up-to-date information — certainly during the Olympiad itself. So, whether you are participating or staying at home, you can always keep in touch with what's happening in Groningen. For people interested in chemistry problems, the site will contain a new and interesting brainteaser every month. During the event, the website will be updated daily, making it the ultimate source for the very latest information. Visit [www.chem.rug.nl/icho34](http://www.chem.rug.nl/icho34), and let us know what you think about it.



## Dear friends, colleagues, and students

The organization team is hard at work; the last details are being taken care of. In a final round of discussions, the scientific committee has scrutinized the assignments for the International Olympiad and locked them away until July.

The Dutch ministry of Education and Science has provided financial support, and so has the University of Groningen. The industry has contributed too, but much less than we initially expected. Chemistry is having a tough time, and this is not only apparent from the reduced interest in the study of Chemistry in many countries.

Still, Chemistry remains a fascinating subject. Anyone reading Oliver Sacks's book 'Uncle Tungsten. Memories of a Chemical Boyhood' will come under the spell of the intense amazement and enjoyment with which young people try to discover the hidden order of the material world. We, colleagues and mentors, were just the same, weren't we? We were so anxious to understand the true nature of metals, salts, gases, and other chemical substances. Although Chemistry lessons at school were sometimes less challenging than we might have expected, we still finished our studies. The fascination for chemical processes that we had when we were young students has always remained an incentive to practice and promote Chemistry.

The primary goal of the International Chemistry Olympiad is to transfer this fascination to promising young people. They should become as curious about the hidden nature of things as we were. A new batch of curious young people from all over the world will gather in the Netherlands in July. Of course, the competition with its theoretical and practical assignments will be the main event. The scores and the medals obtained will receive ample press coverage. But we know better: ultimately, it's about passing on our fascination for the beautiful field of Chemistry.

I wish you all the best with your preparations and hope you will enjoy your journey to Groningen.



See you in July!

**Wout Davids**

*President, 34th International  
Chemistry Olympiad*

## Lessons in Dutch

### Part 2

- |  |  |
|--|--|
| • My name is ...                         | • Mijn naam is...                        |
| • What's your name?                      | • Hoe heet jij?                          |
| • Yes                                    | • Ja                                     |
| • No                                     | • Nee                                    |
| • What time is it?                       | • Hoe laat is het?                       |
| • Where can I find the toilet?           | • Weet u waar de toiletten zijn?         |
| • Please call a doctor.                  | • Wilt u een dokter bellen?              |
| • When does the train/bus to ... depart? | • Wanneer vertrekt de trein/bus naar...? |
| • Where can I find a taxi?               | • Waar vind ik een taxi?                 |
| • I understand.                          | • Ik begrijp het.                        |
| • I don't understand.                    | • Ik begrijp het niet.                   |
| • OK/It's a deal.                        | • Afgesproken.                           |
| • See you later! /Bye bye.               | • Tot straks!                            |
| • That tastes good!                      | • Dat smaakt lekker!                     |
| • With onions, please!                   | • Met uitjes graag!                      |

|                                | MENTORS / SCIENTIFIC OBSERVERS |   | STUDENTS    |  | GUESTS      |  |
|--------------------------------|--------------------------------|---|-------------|--|-------------|--|
| <b>Fri</b><br><b>July 5th</b>  | 09.00- 17.00                   | Registration at Academiegebouw                                      | 09.00-17.00 | Registration at Academiegebouw                               | 09.00-17.00 | Registration at Academiegebouw             |
|                                | 17:00                          | Welcome reception   | 17:00       | Welcome reception  | 17:00       | Welcome reception                          |
|                                | 18:00                          | Dinner at Academiegebouw  | 18:00       | Dinner at Academiegebouw                                     | 18:00       | Dinner at Academiegebouw                   |
|                                | 21:00                          | Departure for hotels Groningen                                      | 21:00       | Departure for hotel Zuidbroek                                | 21:00       | Departure for hotels Groningen             |
| <b>Sat</b><br><b>July 6th</b>  | 11:00                          | Opening Ceremony at Martinkerkerk                                   | 11:00       | Opening Ceremony at Martinikerkerk                           | 11:00       | Opening Ceremony at Martinikerkerk         |
|                                | 13:00                          | Lunch at Academiegebouw   | 13:00       | Lunch at Academiegebouw                                      | 13:00       | Lunch at Academiegebouw                    |
|                                | 14:00                          | Inspection of Laboratories  | 14:00       | Departure for hotel Zuidbroek                                | 14.00-17.00 | City tour Groningen                        |
|                                | 15:00                          | Departure for It Wiid (hotel)                                       | 18:00       | Dinner at hotel  | 17:00       | Departure for It Wiid                      |
|                                | 17.00-18.00                    | consultation with authors   | 20.00-23.00 | Social evening   | 19:00       | Dinner at It Wiid                          |
|                                | 19:00                          | Dinner at hotel   |             |  |             |  |
|                                | 20.00-24.00                    | First Jury Meeting  |             |  |             |  |
| <b>Sun</b><br><b>July 7th</b>  | 08:00                          | Translation Practical Examination                                   | 11:00       | Instruction in Safety practices<br>(in 2 rounds of 4 groups) | 13:00       | Lunch at hotel                             |
|                                | 13:00                          | Lunch at hotel  |             |  | 14.00-17.00 | Excursion Eernewoude                       |
|                                | 14.00-17.00                    | Excursion Eernewoude (optional)                                     | 12:00       | Lunch at hotel   | 19:00       | Dinner at hotel                            |
|                                | 19:00                          | Dinner at hotel   | 13.30-17.00 | Excursion Bourtange  |             |  |
|                                |                                |   | 19:00       | Dinner at hotel  |             |  |
| <b>Mon</b><br><b>July 8th</b>  | 09.00-10.00                    | Breakfast at hotel  | 07:00       | Early breakfast at Hotel                                     | 09.00-10.00 | Breakfast at hotel                         |
|                                | 10.00-16.00                    | Lake-tour Friesland   | 08:00       | Departure for Groningen-<br>University                       | 10.00-16.00 | Lake-tour Friesland                        |
|                                | 16.00-1830                     | Consultation with authors   | 09.00-14.00 | Practical Examination  | 18:00       | Dinner at hotel                            |
|                                |                                | Theoretical Examination   | 16.00-17.30 | Sport activities   | 19.00-23.00 | Excursion to Nij Beets                     |
|                                | 19:00                          | Dinner at hotel   | 17:30       | Departure for Zuidbroek                                      |             |  |
|                                | 20.00-24.00                    | Second Jury Meeting   | 18:30       | Dinner at hotel  |             |  |
|                                |                                |   | 20:00       | Lecture on Chemistry   |             |  |
| <b>Tue</b><br><b>July 9th</b>  | 08.00-17.00                    | Translation Theoretical Examination                                 | 07:00       | Early breakfast at hotel                                     | 08:00       | Breakfast at hotel                         |
|                                | 19.00-23.00                    | Frisian evening   | 08.00-17.00 | Excursion 'Water Management<br>and Chemistry'                | 10.00-19.00 | Excursion in Friesland                     |
|                                |                                |   | 19:00       | Dinner at hotel  | 19.15-23.00 | Frisian evening                            |
| <b>Wed</b><br><b>July 10th</b> | 07:00                          | Early breakfast at hotel  | 07:00       | Early breakfast at hotel                                     | 07:00       | Early breakfast at hotel                   |
|                                | 08.00-22.00                    | Excursion to Amsterdam<br>and surroundings                          | 08:00       | Departure for Groningen University                           | 08.00-22.00 | Excursion to Amsterdam<br>and surroundings |
|                                |                                |   | 09.00-14.00 | Theoretical Examination                                      |             |  |
|                                |                                |   | 15:00       | Departure for Zuidbroek                                      |             |  |
|                                |                                |   | 18:00       | Dinner at hotel  |             |  |
|                                |                                |   | 19.30-01.00 | Evening out in Groningen                                     |             |  |
| <b>Thu</b><br><b>July 11th</b> | 07:00                          | Early breakfast at hotel  | 08.00-10.00 | Breakfast at hotel   | 08:00       | Breakfast at hotel                         |
|                                | whole day                      | Marking examinations or:<br>Excursion, among others 'Skütsjesillen' | 13.00-20.00 | Excursion 'Mega Olympic Games'                               | 09.00-16.00 | Excursion, among others 'Skütsjesillen'    |
|                                | 09.00-16.00                    |   |             |  | 19:00       | Dinner at hotel                            |
|                                | 19:00                          | Dinner at hotel   |             |  |             |  |
|                                | 20.00-24.00                    | Third Jury Meeting (Business)                                       |             |  |             |  |
| <b>Fri</b><br><b>July 12th</b> | from 06.00                     | Early breakfast at hotel  | 06:00       | Early breakfast at hotel                                     | 08:00       | Breakfast at hotel                         |
|                                | 07:00                          | Departure for Groningen:<br>hotels and Martini Plaza                | 07.30-22.00 | Excursion to Amsterdam<br>and surroundings                   | 10:00       | Departure for Groningen<br>hotels          |
|                                | 08:00                          | Arbitration in Martini Plaza<br>start first group                   |             |  | 13.00-17.00 | Excursion Groningen and<br>surroundings    |
|                                | 19:00                          | Dinner at Martini Plaza   |             |  |             |  |
|                                | 20.00-24.00                    | Fourth Jury Meeting:<br>Allocation of medals                        |             |  |             |  |
| <b>Sat</b><br><b>July 13th</b> | 08:00                          | Breakfast at hotel  | 10:30       | Brunch at hotel  | 08:00       | Breakfast at hotel                         |
|                                | 09.00-13.00                    | Free time for shopping<br>and lunch                                 | 12:00       | Departure for Groningen:<br>Free time for shopping           | 09.00-13.00 | Free time for shopping<br>and lunch        |
|                                | 16:00                          | Closing Ceremony<br>at Martini Plaza Theater                        | 14:45       | Departure for Martini Plaza                                  | 16:00       | Closing Ceremony<br>at Martini Plaza       |
|                                | 18:00                          | Aperitif at Martini Plaza   | 15:00       | Rehearsal for the Closing Ceremony                           | 18:00       | Aperitif at Martini Plaza                  |
|                                | 19:00                          | Closing Dinner<br>at Martini Plaza                                  | 16:00       | Closing Ceremony   | 18:00       | Closing Dinner<br>at Martini Plaza         |
|                                | 21.00-24.00                    | Party   | 18:00       | Aperitif   | 19:00       | Closing Dinner<br>at Martini Plaza         |
|                                |                                |   | 19:00       | Closing Dinner   |             |  |
|                                |                                |   | 21.00-24.00 | Party  | 21.00-24.00 | Party                                      |
| <b>Sun</b><br><b>July 14th</b> |                                | Departure   |             | Departure  |             | Departure                                  |

## Buitenplaats It Wiid

The mentors, observers, and guests will stay at "It Wiid" from Saturday afternoon July 6 to the morning of Friday July 12. For the rest of the period, they will be accommodated in hotels in Groningen.

"Buitenplaats It Wiid" is situated near the water sports village of Eernewoude in the middle of the water-rich province of Friesland and in the midst of the beautiful Princehof and Oude Venen nature reserves. The "Buitenplaats" is completely surrounded by nature. The main building has several meeting halls and a large auditorium. The 300 luxury bungalows, dispersed across six islands, will provide sufficient accommodation for all participants. If you appreciate luxury, It Wiid has extensive facilities, including a restaurant, ship's bar, indoor pool, sauna, tennis and squash courts, shop, sailing school and boat rental, bicycle rental, and so on. It is the starting point for sailing trips and tours on in-line skates and mountain bikes in the surrounding area.

Address: Koaidyk 6,  
9264 TP Eernewoude, the Netherlands  
Telephone: +31 (0)511 538 349  
Fax: +31 (0)511 539 496

## The Zuidbroek Sports and Conference Center

The students will be staying at the Zuidbroek Sports and Conference Center for the entire period. The Center is situated in the middle of the province of Groningen. The rooms have all the usual amenities, including color TV. All bathrooms have bath and shower, and each room either has a balcony or a terrace. Everyone is invited to participate in the sports program. For those who are free in the evenings, a complete sports hall is available, including a 25-meter pool. Guests are also free to use the tennis and squash courts, the fitness center, and the recreational pool.

Address: Burgemeester Omtaweg 2-4,  
9636 EM Zuidbroek, the Netherlands  
Telephone: +31 (0)598 453787  
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## Vertis information technology



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Vertis has establishments in Enschede, Groningen, Leidschendam, Veendam and Wageningen and currently employs over 400 people.

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## What's on today's menu?

### "Poffertjes" (mini pancakes)

#### Ingredients

- 125 g flour
- 125 g buckwheat flour
- 1 egg
- 250 ml milk
- approx. 250 ml water
- 15 g fresh yeast (or 1 sachet dried yeast)
- 50 g melted butter
- salt (if the butter is unsalted)

'Poffertjes' are a traditional Dutch treat.

#### Preparation

To bake 'poffertjes', you need a special 'poffertjespan' with indentations with a cross-section of around 3 cm. It is also possible to bake them in a Danish 'aebleskiver' pan or an electrical waffle iron or 'doughnut factory'.

Dissolve the yeast in 3 tablespoons of lukewarm milk. Mix together the flour and the buckwheat flour. Make a smooth batter with the mixed flour, yeast, milk, and water. This batter should not run off the spoon easily, but it should not be too thick either; slowly add the water until the consistency is just right. Then mix in the salt, melted butter, and beaten egg. The batter should be lukewarm. Cover it with a moist dishcloth and let it rise for 30 minutes in a warm location, for instance near a heater, in the hot sun, or in an oven set to 50 °C. Grease the pan with butter and heat it well. Quickly pour a little batter into each indentation. This is most easily done with a squeeze bottle with a medium-sized hole or a spouted pitcher. When the top side is dry, turn over the pancakes with a fork or skewer. The pancakes should be brown on both sides. Eat them when they're hot, with a lump of butter and a lot of powdered sugar on top.



Chemistry students from all over the world will meet in Groningen from 5-14 July. Rohm and Haas, a company that owns a factory in nearby Delfzijl, regards this meeting as an important event. By spending ten days in each other's company, these students will become better acquainted with each other's countries, cultures, and ways of life. In this way, the Chemistry Olympiad will contribute to a more peaceful world. Rohm and Haas wholeheartedly supports this goal.



## Rohm and Haas; the 'doing into it company'

The name "Rohm and Haas" is not well known among consumers, but our company is certainly familiar to manufacturers of consumer goods and business-to-business suppliers. Our products have countless applications: from shampoos to wall-coverings, from car coatings to circuit boards, from diapers to barbecues, and from lingerie to sticky tape — "Rohm and Haas" products can be found almost anywhere. Often, they are materials that improve the final product: the diapers absorb more moisture, the car coatings adhere better and are harder, the tape lasts longer, and the fabrics become more refined. Not for nothing is "quietly improving the quality of life" the motto of Rohm and Haas.

## Rohm and Haas divisions

Worldwide, the company has around 17,500 employees working in more than 100 research and production facilities. Annual turnover is around 6 billion US dollars. This makes Rohm and Haas a

prominent player in the chemical specialties market. The company concentrates on:

**Performance Polymers:** coatings, adhesives and sealants, monomers and plastic additives;

**Salt:** table salt, ice control, water purification, food processing, chemical and industrial use, and agricultural applications;

**Chemical Specialties:** consumer and industrial specialties, ion exchange resins, and inorganic and specialty solutions;

**Electronic Materials:** Shipley Microelectronics, Rodel, Shipley Ronal-technology, and Shipley Electronic and Industrial Finishing.

## Rohm and Haas in the Netherlands and Belgium

The company has two factories in the Netherlands, one in Delfzijl and one in Amersfoort. A branch of Shipley Ronal is located in Den Bosch, and there is a sales office in Antwerp (Belgium). The Amersfoort plant manufactures adhesives for the food processing industry and other industrial applications. The main product of the Delfzijl plant is sodium borohydride.

## More information

For more information, visit our website at [www.rohmhaas.com](http://www.rohmhaas.com), or write to one of our regional offices.

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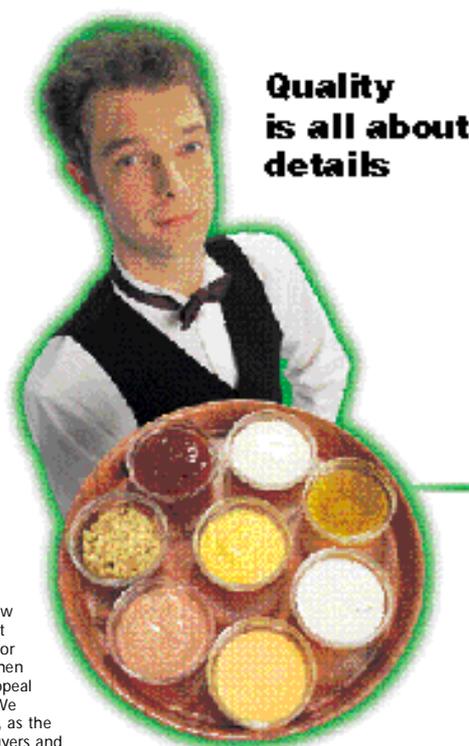
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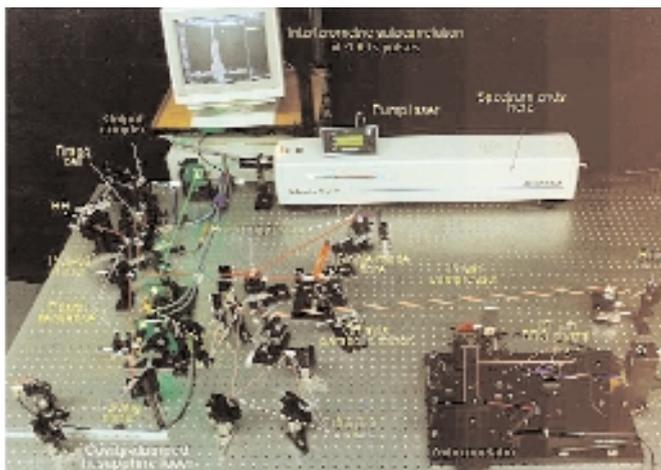
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## *Studying chemical reactions with the fastest lasers in the world*

Chemical equations seem to suggest that we know more about chemical reactions than is really the case. After all, what happens exactly in the instance when a reaction takes place is something that we can still only guess at. Recent developments in scientific research are changing this lack of knowledge. State-of-the-art ultrafast lasers enable us to follow reactions step by tiny step. In 1999, Egyptian scientist Prof. Zewail (1946) was awarded the Nobel Prize for his development of and research with these extremely fast instruments. The fastest laser in the world is situated at the Material Science Center in Groningen.

"What would a football match on TV be without 'slow motion' revealing afterwards the movements of the players and the ball when a goal is scored?" Thus begins the explanation of Zewail's research by The Royal Swedish Academy of Sciences. "Chemical reactions are a similar case. The chemists' eagerness to be able to follow chemical reactions in the greatest detail has prompted increasingly advanced



A laser at the university of Groningen (Cavity-dumped Ti:sapphire laser).

technology. This year's laureate in Chemistry, Ahmed H. Zewail, has studied atoms and molecules in 'slow motion' during a reaction and seen what actually happens when chemical bonds break and new ones are created."

[See next page >>](#)

## *Dear competitors and other guests,*

Some years ago, I was present at the finals of the National Chemistry Olympiad in the Netherlands. I was struck by the contagious enthusiasm of the contestants, which they managed to convey to the scientists and university administrators who were also present. During the prize-giving ceremony, I discussed this with Douwe Wiersma, Dean of the Science Faculty of the University of Groningen, and Eric Bleumink, at the time chairman of the University Executive Board. They agreed with me that the International Chemistry Olympiad should some day be organized in Groningen.

And now this wish has come true, and the Olympiad is about to begin. I am thrilled by the prospect. The organization proved a huge effort, but I am convinced that this Olympiad will be a great success.

An event like the International Chemistry Olympiad is extremely valuable for the internationalization of science. Even before attending university, the Olympiad students will interact with an international forum. Furthermore, it will show them that competition also has a place within science, and that competitive challenges may very well occur outside the domain of sports, in the head, with

experimental skills, craftsmanship, and manual and mental dexterity.

I hope all competitors will enjoy an inspired and pleasant contest and, most of all, a good introduction to the Netherlands, to the University of Groningen, and to the city of Groningen and its Ommelanden region. I also hope that everyone, be they competitors, mentors or other guests, will strike up many and lasting international friendships at this 34th International Chemistry Olympiad. Experience shows that this is usually no problem at all.

Enjoy the entire program!



Prof. Jan H. Teuben  
(Member of  
the Organizing Committee)

**>> The fastest laser**

The technology developed by Prof. Zewail in the late 1980s resembles a wickedly fast movie camera that uses extremely fast laser pulses. Speed is important here, because the shorter the shutter speed, the more details the camera will capture. The shutter speed of a fast but ordinary camera may be as short as 0.00025 seconds, while the "shutter speed" of the lasers is in the range of femtoseconds. A femtosecond (fs) is  $10^{-15}$  second, i.e. 0.000000000000001 second. The name of the field opened up by Zewail's research therefore became "femtochemistry."

**Limit**

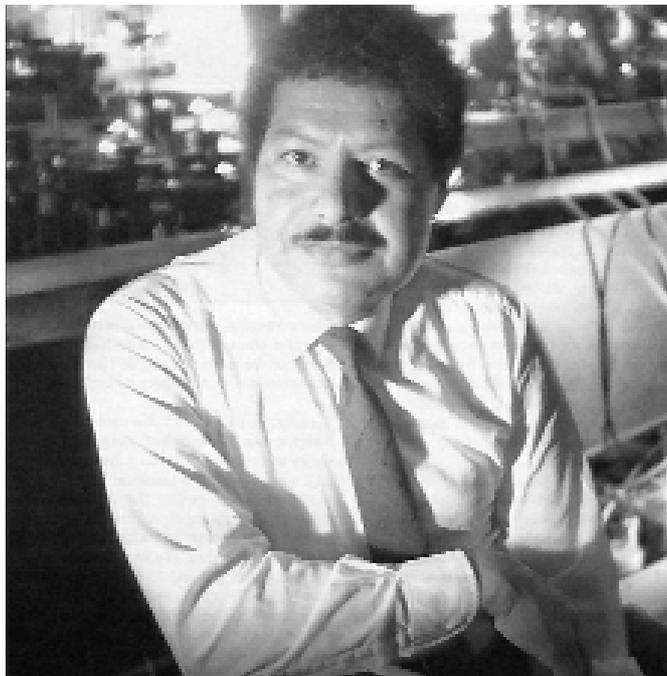
In order to observe the details of a chemical reaction with the camera, two substances are mixed in a vacuum chamber. Then, an ultrafast laser injects two pulses: first, a powerful pump pulse that strikes the molecule and excites it to a higher energy state. This pump pulse initiates the reaction, as it were. After the pump pulse follows the probe pulse, at a wavelength selected to detect the original molecule or an altered form of this molecule. The probe pulse examines what is happening. By varying the time interval between the two pulses, it is possible to see how quickly the original molecule has been transformed. The interval between the laser pulses may be shorter than the time required for an atom to make a single vibration. It usually takes an atom 10 to 100 fs to do so. We have thus reached a limit, concluded the Nobel Prize committee, because no chemical reaction can proceed faster than the time an atom needs for one vibration.

The development of femtochemistry has already led to the discovery of substances found in the reaction process from one product to the next; these substances are called intermediates. These intermediates, whose lifespan is usually extremely brief, form the pieces of the puzzle we need to understand how a chemical reaction works.

**Groningen**

The University of Groningen also has a femtochemistry research group, led by Prof. Koos Duppen and Dr Maxim Pshenichnikov. The Dean of the University, Prof. Douwe Wiersma, has also contributed to this research. As a post-graduate researcher, he worked with Nobel laureate Zewail. The researchers in Groningen are well equipped. They even have the fastest lasers in the world at their disposal. With the test setup in the picture, the Groningen scientists have produced laser pulses of 4.5 fs.

Roughly speaking, the Groningen research is split up into a "Physics" and a "Biology" branch. The Physics branch



Prof. Zewail

studies the ultrafast dynamics of molecules in liquids, for example by disturbing the equilibrium of a molecule in a liquid with a laser pulse and then using a whole series of short laser pulses to observe how this molecule or its environment returns to the rest state.

The Biology branch uses lasers and an extremely high-resolution microscope to study biological samples. One of the projects investigates the distribution and transport of water in living cells. It studies how cells respond to changes in osmotic conditions. Cells use a sophisticated system of active pumps and storage facilities for this purpose. The system is studied by exposing certain cells to a sudden change in the watery environment, for example by rapidly replacing H<sub>2</sub>O with D<sub>2</sub>O.

These are only a few examples of the ongoing research in femtochemistry. Now that chemical reactions no longer occur in an invisible domain, this field of research has witnessed an explosive development. And who knows what other developments this may lead to? "With the world's fastest camera available, only the imagination sets bounds for new problems to tackle," stated the Nobel Prize committee.

*Some of the material in this article had been taken from the 1999 Nobel Prize in Chemistry press release.*

**Tomorrows program****Saturday 06 July 2002****MENTORS / SCIENTIFIC OBSERVERS**

11:00 Opening Ceremony at Martinikerk  
 13:00 Lunch at Academiegebouw  
 14:00 Inspection of Laboratories  
 15:00 Departure for It Wiid (hotel)  
 17:00-18:00 Consultation with authors  
 19:00 Dinner at hotel  
 20:00-24:00 First Jury Meeting

**STUDENTS**

11:00 Opening Ceremony at Martinikerk  
 13:00 Lunch at Academiegebouw  
 14:00 Departure for hotel Zuidbroek  
 18:00 Dinner at hotel  
 20:00-23:00 Social evening

**GUESTS**

11:00 Opening Ceremony at Martinikerk  
 13:00 Lunch at Academiegebouw  
 14:00-17:00 City tour Groningen  
 17:00 Departure for It Wiid  
 19:00 Dinner at It Wiid

Thursday 4 July: A visit to the hosts

## *Behind the scenes: Van der Valk, Zuidbroek*



The hosts have occupied the Van der Valk hotel in Zuidbroek and have made a cursory inspection before the participants arrive: first of the quality of the typically Dutch dinner (Dutch stew with smoked sausage) and then of the swimming pool. Both were given the OK, and the participants are encouraged to make good use of both!

Let's see who some of these hosts are:



Ron Oren, Renze Feitsma, Edwin Otten, and Esther Vertelman have spent the first evening with a few no-holds-barred games of 'klaverjas' (a Dutch card game).

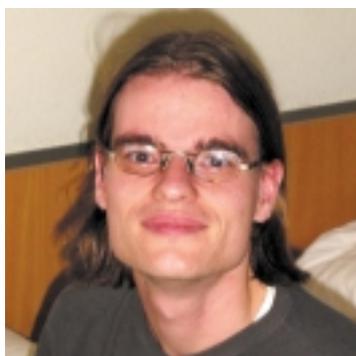
**Ron Oren** is a driver for the Olympiad. He will take care of transportation the entire week. Getting up tomorrow: at 6.30 a.m.; his expectations of the Olympiad: an enjoyable week full of (international) humor.

**Renze Feitsma** will celebrate his birthday on the closing day of the Olympiad (i.e. 13 July) and expects that by then his Irish team will have told him all there is to know about their country. He has never been there, you see (e.g. for a holiday) and so he depends on the group he is hosting to fill in the details. Getting up tomorrow: at 4.45 a.m.; he will then quickly go to Schiphol Amsterdam Airport to welcome and assist arriving delegations all day long. Renze was himself an IChO participant two years ago; he represented the Netherlands in Denmark.

**Edwin Otten's** main interest in the week is not chemistry but satisfying international contacts. He volunteered after he had seen a poster on a wall at the University.

These posters had been put up there by **Esther Vertelman**, the host coordinator. When putting them up, she got excited herself, and joined the Olympiad support team. She misses the tiger print sheets that she had rather expected in this extraordinary hotel room, she explains given the rest of the interior.

But for tiger prints, she can go to her neighbor, **Danièle Gibney**, who has just returned from the swimming pool and is all set to welcome her Australian team.



**Chris Dams** was a participant in the 1994 and 1995 National Chemistry Olympiads and therefore went to China for the International Chemistry Olympiad. He expects to meet a lot of people he met in those days and of course to have a swell time!



**Albert de Graaf** has just returned from the local Aldi supermarket with a packed breakfast. He will also get up at 5.00 a.m. tomorrow, also for a day at Amsterdam Airport to welcome delegations. He participated in the 2000 Olympiad in Copenhagen and has therefore volunteered. With his command of French, he will surely get the best of the French group assigned to him, but it will also be good conversation practice. He hopes the pleasant atmosphere among the hosts will quickly infect the whole group (students and hosts) and looks forward to for a violent chemical reaction between all people involved in the Olympiad.

| FAMILYNAME          | INITIALS | SEX | CATEGORY            | COUNTRY    |
|---------------------|----------|-----|---------------------|------------|
| OLABE               | J.A.     | M   | HEAD MENTOR         | ARGENTINA  |
| BONESI              | S.M.     | M   | MENTOR              | ARGENTINA  |
| SCIENTIFIC OBSERVER |          | M   | SCIENTIFIC OBSERVER | ARGENTINA  |
| NUÑEZ               | P.       | M   | STUDENT             | ARGENTINA  |
| ABERBUJ             | P.       | M   | STUDENT             | ARGENTINA  |
| SALIERNO            | G.       | M   | STUDENT             | ARGENTINA  |
| CORDONE             | M.       | M   | STUDENT             | ARGENTINA  |
| GRUMMITT            | A.       | F   | HEAD MENTOR         | AUSTRALIA  |
| WALLIS              | T.       | M   | MENTOR              | AUSTRALIA  |
| SALEM               | G.       | M   | SCIENTIFIC OBSERVER | AUSTRALIA  |
| TILDEN              | A.       | F   | GUEST               | AUSTRALIA  |
| TENG                | G.       | M   | STUDENT             | AUSTRALIA  |
| THORN-SESHOLD       | O.       | M   | STUDENT             | AUSTRALIA  |
| SALMAN              | S.       | M   | STUDENT             | AUSTRALIA  |
| WONG                | A.       | M   | STUDENT             | AUSTRALIA  |
| ALSFORD             | M.       | M   | GUEST               | AUSTRALIA  |
| KERSCHBAUMER        | M.       | M   | HEAD MENTOR         | AUSTRIA    |
| BERNER              | L.       | F   | MENTOR              | AUSTRIA    |
| KOLLER              | D.       | M   | STUDENT             | AUSTRIA    |
| LUDL                | P.       | M   | STUDENT             | AUSTRIA    |
| STECHER             | T.       | M   | STUDENT             | AUSTRIA    |
| THALHAMMER          | A.       | M   | STUDENT             | AUSTRIA    |
| AKYOL               | A.       | M   | SCIENTIFIC OBSERVER | AZERBAIJAN |
| ABBASOV             | V.       | M   | HEAD MENTOR         | AZERBAIJAN |
| ABBASOV             | M.       | M   | MENTOR              | AZERBAIJAN |
| CAVADOV             | A.       | M   | STUDENT             | AZERBAIJAN |
| HEYBATOV            | E.       | M   | STUDENT             | AZERBAIJAN |
| DAVUDOV             | D.       | M   | STUDENT             | AZERBAIJAN |
| MUSAYEV             | O.       | M   | STUDENT             | AZERBAIJAN |
| KHVALYUK            | V.       | M   | HEAD MENTOR         | BELARUS    |
| VORONKOVA           | E.       | F   | MENTOR              | BELARUS    |
| PUTAU               | A.       | M   | STUDENT             | BELARUS    |
| MENSHYKAU           | D.       | M   | STUDENT             | BELARUS    |
| PIATKEVICH          | K.       | M   | STUDENT             | BELARUS    |
| ZHDANKO             | A.       | M   | STUDENT             | BELARUS    |
| JANSSENS            | H.       | F   | HEAD MENTOR         | BELGIUM    |
| MERCINY             | L.       | F   | MENTOR              | BELGIUM    |
| IDCZAK              | J.       | M   | SCIENTIFIC OBSERVER | BELGIUM    |
| VERCAUTEREN         | D.       | M   | STUDENT             | BELGIUM    |
| TASSIN              | C.       | M   | STUDENT             | BELGIUM    |
| JOTTRAND            | L.       | M   | STUDENT             | BELGIUM    |
| COLLIGNON           | M.-L.    | F   | STUDENT             | BELGIUM    |
| MAIA MELO           | S.       | M   | HEAD MENTOR         | BRAZIL     |
| DANTAS LOPES        | J.A.     | M   | MENTOR              | BRAZIL     |
| OLIVEIRA            | A.       | M   | SCIENTIFIC OBSERVER | BRAZIL     |
| SOUZA CARVALHO MELO | L.       | F   | SCIENTIFIC OBSERVER | BRAZIL     |
| TAJRA FONTELES      | R.       | M   | STUDENT             | BRAZIL     |
| SAMMUEL COSTA DE MO | Y.       | M   | STUDENT             | BRAZIL     |
| PEREIRA SARAIVA     | J.       | M   | STUDENT             | BRAZIL     |
| MAIA DE OLIVEIRA    | A.       | M   | STUDENT             | BRAZIL     |
| PEKOV               | G.       | M   | HEAD MENTOR         | BULGARIA   |
| IEIEV               | I.       | M   | MENTOR              | BULGARIA   |
| SHUSHKOV            | F.       | M   | STUDENT             | BULGARIA   |
| PASHOV              | D.       | M   | STUDENT             | BULGARIA   |
| BELEZHANSKA         | Y.       | F   | STUDENT             | BULGARIA   |
| IVANOV              | D.       | M   | STUDENT             | BULGARIA   |
| BATES               | G.       | M   | HEAD MENTOR         | CANADA     |
| FILTEAU             | C.       | F   | MENTOR              | CANADA     |
| HONG                | L.       | M   | STUDENT             | CANADA     |
| KIM                 | J.H.     | M   | STUDENT             | CANADA     |
| TSENG               | W.L.     | M   | STUDENT             | CANADA     |
| YEUNG               | S.H.     | M   | STUDENT             | CANADA     |
| DUAN                | L.       | M   | HEAD MENTOR         | CHINA      |
| CHEN                | D.       | M   | MENTOR              | CHINA      |
| PEI                 | J.       | M   | SCIENTIFIC OBSERVER | CHINA      |
| WANG                | F.       | M   | STUDENT             | CHINA      |
| ZHU                 | Y.       | M   | STUDENT             | CHINA      |
| LIU                 | W.       | M   | STUDENT             | CHINA      |
| LU                  | H.       | M   | STUDENT             | CHINA      |
| ZHAO                | H.       | M   | GUEST               | CHINA      |
| ZORC                | B.       | F   | HEAD MENTOR         | CROATIA    |
| KRONJA              | O.       | F   | MENTOR              | CROATIA    |
| FRANJE              | N.       | M   | STUDENT             | CROATIA    |
| KASSAL              | I.       | M   | STUDENT             | CROATIA    |
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| PÚREZ BARZAGA       | V.       | M   | STUDENT             | CUBA       |
| HERNÁNDEZ GONZÁLEZ  | J.E.     | M   | STUDENT             | CUBA       |
| BRAVO RODRÍGUEZ     | K.       | M   | STUDENT             | CUBA       |
| GONZÁLEZ VALDÉS     | I.B.     | F   | STUDENT             | CUBA       |

|                     |      |   |                     |                |
|---------------------|------|---|---------------------|----------------|
| NICOLAOU            | M.   | M | HEAD MENTOR         | CYPRUS         |
| ANASTASIADOU        | L.   | F | MENTOR              | CYPRUS         |
| NICOLAIDIS          | C.   | M | STUDENT             | CYPRUS         |
| KOUPPARIS           | K.   | M | STUDENT             | CYPRUS         |
| VOLOS               | S.   | M | STUDENT             | CYPRUS         |
| MATSIKARIS          | K.   | M | STUDENT             | CYPRUS         |
| SEJBAL              | J.   | M | HEAD MENTOR         | CZECH REPUBLIC |
| SLAVICEK            | P.   | M | MENTOR              | CZECH REPUBLIC |
| PLUHAROVÁ           | E.   | F | STUDENT             | CZECH REPUBLIC |
| DRAHOS              | B.   | M | STUDENT             | CZECH REPUBLIC |
| CHUDOBA             | R.   | M | STUDENT             | CZECH REPUBLIC |
| MIKULKA             | T.   | M | STUDENT             | CZECH REPUBLIC |
| NIELSEN             | K.B. | M | HEAD MENTOR         | DENMARK        |
| JESPERGAARD         | P.   | M | MENTOR              | DENMARK        |
| ANTHON              | C.   | M | SCIENTIFIC OBSERVER | DENMARK        |
| KRISTIANSEN         | M.   | M | STUDENT             | DENMARK        |
| LAURIDSEN           | T.   | M | STUDENT             | DENMARK        |
| ERSBAK BANG NIELSEN | A.   | F | STUDENT             | DENMARK        |
| WALDORFF            | D.   | F | STUDENT             | DENMARK        |
| HELAL               | A.   | M | MENTOR              | EGYPT          |
| HASSAN              | S.   | M | HEAD MENTOR         | EGYPT          |
| FARAG               | A.   | M | SCIENTIFIC OBSERVER | EGYPT          |
| ZHRAN               | N.   | F | STUDENT             | EGYPT          |
| ABD-ELMALCK         | M.   | F | STUDENT             | EGYPT          |
| SOUBIH              | A.   | M | STUDENT             | EGYPT          |
| YEHYA               | A.   | M | STUDENT             | EGYPT          |
| GABR                | R.   | M | GUEST               | EGYPT          |
| ABD-ELMONEIM        | Y.   | M | GUEST               | EGYPT          |
| PULLERITS           | R.   | M | HEAD MENTOR         | ESTONIA        |
| MÄEORG              | U.   | M | MENTOR              | ESTONIA        |
| STARKOV             | P.   | M | STUDENT             | ESTONIA        |
| IVANISTSEV          | V.   | M | STUDENT             | ESTONIA        |
| TAMJAR              | E.   | F | STUDENT             | ESTONIA        |
| KARUS               | S.   | M | STUDENT             | ESTONIA        |
| NÁSÁKKALÁ           | M.   | M | HEAD MENTOR         | FINLAND        |
| KOSKIMIES           | J.   | M | MENTOR              | FINLAND        |
| MONTONEN            | M.   | F | SCIENTIFIC OBSERVER | FINLAND        |
| JÄRVINGEN           | T.   | M | STUDENT             | FINLAND        |
| KANGASNIGMI         | T.   | M | STUDENT             | FINLAND        |
| RASALA              | T.   | M | STUDENT             | FINLAND        |
| VALKAMA             | P.   | M | STUDENT             | FINLAND        |
| BERNARD             | M.   | M | HEAD MENTOR         | FRANCE         |
| SCHILTZ             | S.   | F | MENTOR              | FRANCE         |
| PLAIDY              | O.   | M | SCIENTIFIC OBSERVER | FRANCE         |
| BOCQUET             | A.   | M | STUDENT             | FRANCE         |
| CARTIGNY            | D.   | M | STUDENT             | FRANCE         |
| MANSERAND           | B.   | M | STUDENT             | FRANCE         |
| SCHILTZ             | S.   | M | STUDENT             | FRANCE         |
| HAMPE               | W.   | M | HEAD MENTOR         | GERMANY        |
| BARK                | T.   | M | MENTOR              | GERMANY        |
| KLUEPFEL            | S.   | M | STUDENT             | GERMANY        |
| LEDOCHO-WITSCH      | P.   | M | STUDENT             | GERMANY        |
| PLATE               | L.   | M | STUDENT             | GERMANY        |
| RODENBERG           | A.   | M | STUDENT             | GERMANY        |
| TSATSAS             | A.   | M | HEAD MENTOR         | GREECE         |
| CHINIADES           | D.   | M | MENTOR              | GREECE         |
| KORDONIS            | I.   | M | STUDENT             | GREECE         |
| THEODORO-POULOU     | S.   | F | STUDENT             | GREECE         |
| MARINO-POULOS       | K.   | M | STUDENT             | GREECE         |
| MOUSTAKAS           | N.   | M | STUDENT             | GREECE         |
| KOINIS              | S.   | M | SCIENTIFIC OBSERVER | GREECE         |
| PSAROUDADIS         | N.   | M | SCIENTIFIC OBSERVER | GREECE         |
| SALTA               | K.   | F | SCIENTIFIC OBSERVER | GREECE         |
| BAKOGIANNIS         | C.   | M | SCIENTIFIC OBSERVER | GREECE         |
| MAGYARFALVI         | G.   | M | HEAD MENTOR         | HUNGARY        |
| KÓCZÁN              | G.   | M | MENTOR              | HUNGARY        |
| VILLÁNYI            | A.   | M | SCIENTIFIC OBSERVER | HUNGARY        |
| SZALAY              | Z.   | F | STUDENT             | HUNGARY        |
| BALOGH              | J.   | M | STUDENT             | HUNGARY        |
| PARAZS              | D.   | M | STUDENT             | HUNGARY        |
| BEIN                | M.   | M | STUDENT             | HUNGARY        |
| BJÖRGVINSSON        | M.   | M | HEAD MENTOR         | ICELAND        |
| OSKARSSON           | S.   | M | MENTOR              | ICELAND        |
| JÓNSSON             | E.   | M | STUDENT             | ICELAND        |
| FLOSADÓTTIR         | H.D. | F | STUDENT             | ICELAND        |
| ÓMARSÓTTIR          | L.Ó. | F | STUDENT             | ICELAND        |
| SIGHVATSSON         | H.   | M | STUDENT             | ICELAND        |
| FLOSADÓTTIR         | A.   | F | OUTSIDER            | ICELAND        |
| VANKAR              | Y.D. | M | HEAD MENTOR         | INDIA          |
| PRABHU              | D.   | M | MENTOR              | INDIA          |
| KRISHNAN            | A.   | M | STUDENT             | INDIA          |
| DEWANI              | S.   | M | STUDENT             | INDIA          |
| SHIVARAMAN          | S.   | M | STUDENT             | INDIA          |
| KUMAR               | S.   | M | STUDENT             | INDIA          |
| SIHOMBING           | R.   | M | HEAD MENTOR         | INDONESIA      |
| FRANISAL            | N.   | M | MENTOR              | INDONESIA      |

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|---------------------|------|---|---------------------|-------------|
| MOENANDAR           | I.   | M | SCIENTIFIC OBSERVER | INDONESIA   |
| ZAMRONI             | M.   | F | GUEST               | INDONESIA   |
| ABDILLAH            | P.A. | M | STUDENT             | INDONESIA   |
| JIMRON              | B.   | M | STUDENT             | INDONESIA   |
| SALIM               | T.   | M | STUDENT             | INDONESIA   |
| TAUFIQURROHMAN      | M.F. | M | STUDENT             | INDONESIA   |
| ABEDINI             | M.   | M | HEAD MENTOR         | IRAN        |
| KIANI               | R.   | M | MENTOR              | IRAN        |
| TORABI              | N.   | F | STUDENT             | IRAN        |
| AQAIARY             | J.   | M | STUDENT             | IRAN        |
| SHAHI               | M.   | M | STUDENT             | IRAN        |
| SHIRDEL             | M.   | M | STUDENT             | IRAN        |
| SEYEDI ESFAHANI     | S.   | M | SCIENTIFIC OBSERVER | IRAN        |
| GHABEL RAHMAT       | A.   | F | OUTSIDER            | IRAN        |
| JAMES               | P.   | M | HEAD MENTOR         | IRELAND     |
| BROWNE              | W.   | M | MENTOR              | IRELAND     |
| TONER               | D.   | F | STUDENT             | IRELAND     |
| MALOFFEEV           | V.   | M | STUDENT             | IRELAND     |
| MC GEE              | P.   | F | STUDENT             | IRELAND     |
| MAC NAMARA          | M.   | M | STUDENT             | IRELAND     |
| ANASTASIA           | M.   | M | HEAD MENTOR         | ITALY       |
| GORI                | S.   | M | MENTOR              | ITALY       |
| ROSI                | G.   | M | STUDENT             | ITALY       |
| DI ANTONIO          | M.   | M | STUDENT             | ITALY       |
| CREATI              | F.   | M | STUDENT             | ITALY       |
| CERICOLA            | D.   | M | STUDENT             | ITALY       |
| BAMBA               | E.   | M | SCIENTIFIC OBSERVER | IVORY COAST |
| DION                | M.   | M | SCIENTIFIC OBSERVER | IVORY COAST |
| MORI                | A.   | M | SCIENTIFIC OBSERVER | JAPAN       |
| ITO                 | M.   | M | SCIENTIFIC OBSERVER | JAPAN       |
| NODA                | Y.   | M | SCIENTIFIC OBSERVER | JAPAN       |
| MENDIGALIYEVA       | S.   | F | HEAD MENTOR         | KAZAKHSTAN  |
| BEKISHEV            | K.   | M | MENTOR              | KAZAKHSTAN  |
| NURTAZIN            | A.   | M | STUDENT             | KAZAKHSTAN  |
| NURGABDESHOV        | A.   | M | STUDENT             | KAZAKHSTAN  |
| ISKAKOV             | A.   | M | STUDENT             | KAZAKHSTAN  |
| TULEBEKOV           | Y.   | M | STUDENT             | KAZAKHSTAN  |
| KIM                 | H.   | M | HEAD MENTOR         | KOREA       |
| SHIN                | S.   | M | MENTOR              | KOREA       |
| LEE                 | D.   | M | SCIENTIFIC OBSERVER | KOREA       |
| MOON                | H.J. | M | SCIENTIFIC OBSERVER | KOREA       |
| KIM                 | M.H. | M | STUDENT             | KOREA       |
| KIM                 | I.S. | M | STUDENT             | KOREA       |
| LEE                 | J.H. | M | STUDENT             | KOREA       |
| KIM                 | Y.J. | M | STUDENT             | KOREA       |
| HWANG               | J.Y. | M | SCIENTIFIC OBSERVER | KOREA       |
| KIM                 | S.J. | M | SCIENTIFIC OBSERVER | KOREA       |
| HADI                | B.   | M | HEAD MENTOR         | KUWAIT      |
| ABDULLAH            | A.   | F | MENTOR              | KUWAIT      |
| ALJASSAR            | F.   | M | STUDENT             | KUWAIT      |
| ABDULJABAR / ALFELA | R.   | F | STUDENT             | KUWAIT      |
| BARON               | F.   | F | STUDENT             | KUWAIT      |
| ALHASAN             | L.   | F | STUDENT             | KUWAIT      |
| ALEBRAHEM           | A.   | F | SCIENTIFIC OBSERVER | KUWAIT      |
| ABDAL               | F.   | M | GUEST               | KUWAIT      |
| ATTALLAH            | S.   | M | GUEST               | KUWAIT      |
| KOSOBAYEVA          | B.   | F | HEAD MENTOR         | KYRGYZSTAN  |
| JUSAEVA             | S.   | F | MENTOR              | KYRGYZSTAN  |
| AMATOV              | T.   | M | STUDENT             | KYRGYZSTAN  |
| JUMABAEV            | S.   | M | STUDENT             | KYRGYZSTAN  |
| ESTEBESOV           | E.   | M | STUDENT             | KYRGYZSTAN  |
| SABYROV             | K.   | M | STUDENT             | KYRGYZSTAN  |
| PAKULE              | S.   | F | HEAD MENTOR         | LATVIA      |
| GIBIETIS            | J.   | M | MENTOR              | LATVIA      |
| STUDENT1            |      | M | STUDENT             | LATVIA      |
| STUDENT2            |      | M | STUDENT             | LATVIA      |
| STUDENT3            |      | M | STUDENT             | LATVIA      |
| STUDENT4            |      | M | STUDENT             | LATVIA      |
| BUTKUS              | E.   | M | HEAD MENTOR         | LITHUANIA   |
| RAUDONIS            | R.   | M | MENTOR              | LITHUANIA   |
| BACELIS             | J.   | M | STUDENT             | LITHUANIA   |
| BAGDZIUNAS          | G.   | M | STUDENT             | LITHUANIA   |
| TAMOSIUNAS          | P.   | M | STUDENT             | LITHUANIA   |
| KUBILIUS            | J.   | M | STUDENT             | LITHUANIA   |
| DOMINGUEZ           | R.   | M | HEAD MENTOR         | MEXICO      |
| LEON                | F.   | M | MENTOR              | MEXICO      |
| CASTRO              | C.   | M | SCIENTIFIC OBSERVER | MEXICO      |
| YUEN ZHOU           | J.   | M | STUDENT             | MEXICO      |
| JIMÉNEZ HOYOS       | C.A. | M | STUDENT             | MEXICO      |
| MÁRQUEZ SALCEDO     | A.   | F | STUDENT             | MEXICO      |
| DÍAZ TINOCO         | M.A. | M | STUDENT             | MEXICO      |
| TUMUROCHIR          | D.   | M | SCIENTIFIC OBSERVER | MONGOLIA    |
| GAST 1              |      | M | GUEST               | MONGOLIA    |

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|---------------------|-------------|---|---------------------|--------------------|
| KLEIJN              | E.H.M.H. DE | M | HEAD MENTOR         | NEDERLAND          |
| BROENS              | J.B.        | M | MENTOR              | NEDERLAND          |
| MOONS               | H.          | M | STUDENT             | NEDERLAND          |
| CNOSEN              | A.          | M | STUDENT             | NEDERLAND          |
| GROOTE              | R.          | M | STUDENT             | NEDERLAND          |
| ROSENTHAL           | A.          | M | STUDENT             | NEDERLAND          |
| NGUYEN VIET         | C.          | M | STUDENT             | NEDERLAND          |
| MACLAGAN            | R.          | M | HEAD MENTOR         | NEW ZEALAND        |
| BONIFACE            | S.          | F | MENTOR              | NEW ZEALAND        |
| WOODGATE            | S.          | F | SCIENTIFIC OBSERVER | NEW ZEALAND        |
| LAU                 | P.          | M | STUDENT             | NEW ZEALAND        |
| MASON               | G.          | F | STUDENT             | NEW ZEALAND        |
| PENG                | K.          | M | STUDENT             | NEW ZEALAND        |
| YEUSLEY             | A.          | M | STUDENT             | NEW ZEALAND        |
| IMADE               | K.N.        | M | SCIENTIFIC OBSERVER | NIGERIA            |
| FURUETH             | S.          | F | HEAD MENTOR         | NORWAY             |
| STORM               | B.          | F | MENTOR              | NORWAY             |
| MABERG              | O.          | M | SCIENTIFIC OBSERVER | NORWAY             |
| FORLAND             | M.          | F | STUDENT             | NORWAY             |
| LINDSTROM           | C.          | F | STUDENT             | NORWAY             |
| LUDVIGSEN           | M.          | F | STUDENT             | NORWAY             |
| VESTLI              | K.          | M | STUDENT             | NORWAY             |
| GHONG               | M.          | M | SCIENTIFIC OBSERVER | PERU               |
| MIZERSKI            | T.          | M | HEAD MENTOR         | POLAND             |
| ORLIK               | M.          | M | MENTOR              | POLAND             |
| SKOMOROWSKI         | W.          | M | STUDENT             | POLAND             |
| KARBOWNIK           | M.          | M | STUDENT             | POLAND             |
| KALEK               | M.          | M | STUDENT             | POLAND             |
| BIL                 | J.          | M | STUDENT             | POLAND             |
| RIBEIRO CLARO       | P.          | M | SCIENTIFIC OBSERVER | PORTUGAL           |
| VLADESCU            | L.          | F | HEAD MENTOR         | ROMANIA            |
| MENTOR 2 ROMANIA    |             | M | MENTOR              | ROMANIA            |
| SIMA                | S.          | M | STUDENT             | ROMANIA            |
| NEDELCU             | D.          | M | STUDENT             | ROMANIA            |
| RACOVITA            | R.C.        | M | STUDENT             | ROMANIA            |
| GLAVAN              | A.          | F | STUDENT             | ROMANIA            |
| MELTZER             | V.          | F | SCIENTIFIC OBSERVER | ROMANIA            |
| BALTA               | N.          | F | GUEST               | ROMANIA            |
| EREMIN              | V.V.        | M | HEAD MENTOR         | RUSSIAN FEDERATION |
| SOUMATOKHIHE        | S.          | M | MENTOR              | RUSSIAN FEDERATION |
| GLADILIN            | A.          | M | SCIENTIFIC OBSERVER | RUSSIAN FEDERATION |
| SOLOVYEV            | A.          | M | STUDENT             | RUSSIAN FEDERATION |
| LARIONOV            | E.          | M | STUDENT             | RUSSIAN FEDERATION |
| SEDOV               | I.          | M | STUDENT             | RUSSIAN FEDERATION |
| GLEBOV              | I.          | M | STUDENT             | RUSSIAN FEDERATION |
| NENAIENKO           | V.          | M | GUEST               | RUSSIAN FEDERATION |
| LAI                 | Y.H.        | M | HEAD MENTOR         | SINGAPORE          |
| FAN                 | W.Y.        | F | MENTOR              | SINGAPORE          |
| CHUA                | L.H.        | M | SCIENTIFIC OBSERVER | SINGAPORE          |
| LUI                 | P.L.        | M | STUDENT             | SINGAPORE          |
| TAN                 | C.G.        | M | STUDENT             | SINGAPORE          |
| WANG                | R.R.        | F | STUDENT             | SINGAPORE          |
| TAN                 | Y.X.        | F | STUDENT             | SINGAPORE          |
| SIROTA              | A.          | M | HEAD MENTOR         | SLOVAKIA           |
| SALISOVÁ            | M.          | F | MENTOR              | SLOVAKIA           |
| HROBÁRIK            | T.          | M | STUDENT             | SLOVAKIA           |
| KARLUBÍKOVÁ         | O.          | F | STUDENT             | SLOVAKIA           |
| REPKO               | A.          | M | STUDENT             | SLOVAKIA           |
| SZABO               | E.          | M | STUDENT             | SLOVAKIA           |
| DOLENC              | D.          | M | HEAD MENTOR         | SLOVENIA           |
| GROS                | N.          | F | MENTOR              | SLOVENIA           |
| GRADISEK            | T.          | M | STUDENT             | SLOVENIA           |
| RADE                | K.          | F | STUDENT             | SLOVENIA           |
| RODMAN              | J.          | F | STUDENT             | SLOVENIA           |
| SIVIC               | K.          | M | STUDENT             | SLOVENIA           |
| RODRÍGUEZ-RENUNCIÓ  | J.A.        | M | HEAD MENTOR         | SPAIN              |
| CASTAGENA-CAUSAPÉ   | M.          | F | MENTOR              | SPAIN              |
| IRANZO SANZ         | J.          | M | STUDENT             | SPAIN              |
| CEBALLOS CARRAS-COS | P.          | F | STUDENT             | SPAIN              |
| MARTI CENTELLES     | V.          | M | STUDENT             | SPAIN              |
| ENCISO CARRASCO     | M.          | F | STUDENT             | SPAIN              |
| LATRE DAVID         | F.          | M | SCIENTIFIC OBSERVE  | SPAIN              |
| GORBE RUIZ          | D.          | F | GUEST               | SPAIN              |
| BÄCKLUND            | G.          | F | HEAD MENTOR         | SWEDEN             |
| LINDGREN            | P.          | M | MENTOR              | SWEDEN             |
| HOLMQVIST           | J.          | M | STUDENT             | SWEDEN             |
| MERTALA             | A.          | F | STUDENT             | SWEDEN             |
| GENBERG             | J.          | M | STUDENT             | SWEDEN             |
| COORAY              | C.          | M | STUDENT             | SWEDEN             |
| MUELLER             | J.          | M | HEAD MENTOR         | SWITZERLAND        |
| WEIBEL              | B.          | F | MENTOR              | SWITZERLAND        |
| KÖTYRBA             | M.          | M | STUDENT             | SWITZERLAND        |
| LUDWIG              | P.          | M | STUDENT             | SWITZERLAND        |

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|---|---|-------------------------------|---|--|
| PAZHEPURACKEL SCHNEEBELI  | V. S.   | F. M.                         | STUDENT STUDENT   | SWITZERLAND SWITZERLAND  |
| LEE HUANG FENG FANG TZENG YAO LIN WANG TSAI LIN LEE   | C.-K. J.-H. S.L. T.-S. H. C.F. C.-J. Y.-C. C.-Y. C.Y. M.-T. | M. M. M. M. F. M. M. M. F.    | HEAD MENTOR MENTOR SCIENTIFIC OBSERVER GUEST GUEST GUEST GUEST STUDENT STUDENT STUDENT STUDENT GUEST          | TAIWAN                              |
| AYSU  | T.  | M.                            | SCIENTIFIC OBSERVER   | TAJIKISTAN   |
| CHUANKRERKKUL PARASUK WONGCHAIUWAT THOOPANOM UTTAMAPINANT NETIROJJANAKUL JIRAPINYO NAKORNCHAI LEONGARAMCHOTI PANJAPAN CHUANKRERKKUL | N. W. A. N. C. C. D. B. N.                                  | F. F. F. M. M. F. F. F. M. F. | HEAD MENTOR MENTOR SCIENTIFIC OBSERVER GUEST STUDENT STUDENT STUDENT STUDENT STUDENT STUDENT STUDENT OUTSIDER | THAILAND |
| USANMAZ DOGAN WEGNER ÖZKALAY ISLI BARIN   | A. O. S. B. M. G.   | M. M. F. F. M. M.             | HEAD MENTOR MENTOR STUDENT STUDENT STUDENT STUDENT  | TURKEY TURKEY TURKEY TURKEY TURKEY   |
| AYYILDIZ KURBANOV HODJONAZAROV BEGLRYEV HAYFIYEV ROZIYEV  | I. D. N. A. S. P.   | M. M. M. M. M. M.             | MENTOR HEAD MENTOR STUDENT STUDENT STUDENT STUDENT  | TURKMENISTAN TURKMENISTAN TURKMENISTAN TURKMENISTAN TURKMENISTAN TURKMENISTAN                      |
| MALCHENKO KHOLIN GOROKHOV PANOV RADCHENKO   | G. Y. A. D. D.  | F. M. M. M. M.                | HEAD MENTOR MENTOR STUDENT STUDENT STUDENT  | UKRAINE UKRAINE UKRAINE UKRAINE UKRAINE  |

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|---|------------------------------|----------------------------------|--|---|
| VECHORKIN   | O.                           | M.                               | STUDENT  | UKRAINE   |
| WOTHERS HARSEY STANBURY STUDENT 1 UK STUDENT 2 UK STUDENT 3 UK STUDENT 4 UK   | P. T. L.                     | M. M. F. M. M. M.                | HEAD MENTOR MENTOR SCIENTIFIC OBSERVER STUDENT STUDENT STUDENT STUDENT                                   | UNITED KINGDOM UNITED KINGDOM UNITED KINGDOM UNITED KINGDOM UNITED KINGDOM UNITED KINGDOM |
| NAGURNEY SUMERLIN CISSELL SHI WHITTAKER DAVENPORT   | J. N. D. H. C. T.            | F. M. M. F. M. M.                | HEAD MENTOR MENTOR STUDENT STUDENT STUDENT STUDENT   | UNITED STATES UNITED STATES UNITED STATES UNITED STATES UNITED STATES UNITED STATES       |
| STEBNIKI MENTOR 2 URUGUAY STUDENT 1 URUGUAY STUDENT 2 URUGUAY STUDENT 3 URUGUAY STUDENT 4 URUGUAY                                 | W.                           | M. M. M. M. M. M.                | HEAD MENTOR MENTOR STUDENT STUDENT STUDENT STUDENT   | URUGUAY URUGUAY URUGUAY URUGUAY URUGUAY URUGUAY   |
| TORREALBA SILVA ZAPATA BACALLADO PLAZAS LUNAR BUONACCORDO MODESTINO PATINO  | A. E. E. S. M. M. J. M. M.F. | F. M. M. M. F. F. M. F.          | HEAD MENTOR MENTOR SCIENTIFIC OBSERVER STUDENT STUDENT GUEST GUEST STUDENT STUDENT                       | VENEZUELA VENEZUELA VENEZUELA VENEZUELA VENEZUELA VENEZUELA VENEZUELA VENEZUELA VENEZUELA |
| BACALLADO GARCIA  | E. DE A.                     | F. M.                            | OUTSIDER OUTSIDER  | VENEZUELA VENEZUELA   |
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**Mallinckrodt Baker**



Ministry of Economic Affairs



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Milieuwet 1991 Uitvoering Cultuur en Waterschappen



34<sup>th</sup> International  
CHEMISTRY OLYMPIAD

Groningen | The Netherlands | 5 - 14 July 2002

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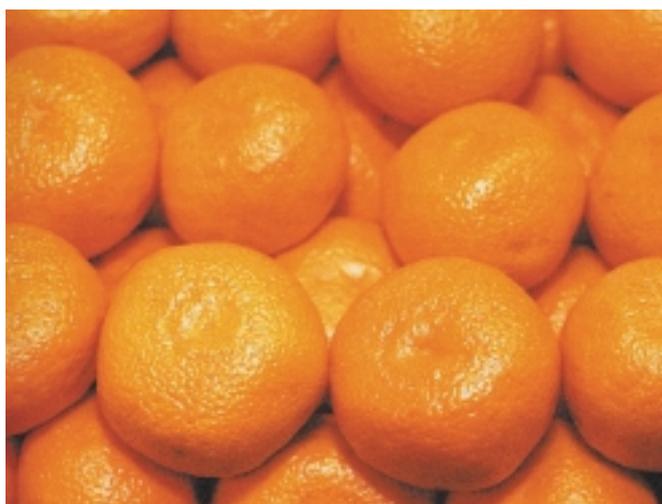
A. van der Gen

## *Vitamins in wartime*

In the summer of 1941, Coco Arens and Davy van Dorp (both 26 years old and recently awarded doctorates in Amsterdam) entered the employ of Organon in Oss. In 1939, the company began to market the Davitamon 5 vitamin preparation. The product became highly popular, especially when the food situation deteriorated during the German occupation. Davitamon 5 contains vitamins A and C, substances that became increasingly scarce as the war continued. It seemed obvious, therefore, to look for a synthesis. In January 1943, the occupying forces incorporated Organon in Schering A.G., a major pharmaceutical company based in Berlin. Schering sent Dr H.H. Inhoffen (who was later to become a professor at Braunschweig University) to Oss to lead the research efforts. The first assignment Inhoffen — a highly motivated scientist and not a fanatical Nazi — gave to the young Dutch scientists was “synthesize vitamin A and similar substances.” Each time Inhoffen was recalled to Berlin for a meeting, he returned with suitcases full of valuable chemicals and glassware of a quality that could not be had in the Netherlands.

### Nature

Arens and Van Dorp succeeded in their efforts and, late in 1945, they sent a manuscript to the prestigious scientific journal Nature in which they described the synthesis of vitamin A acid. This publication came as a real bombshell, since prominent research groups around the world had been working on the synthesis of the equivalent alcohol, vitamin A, for many years. Nobody could have imagined that it would be possible for scientists in the occupied Netherlands to create such a difficult molecule. With vitamin A acid available, the synthesis of vitamin A itself seemed a piece of cake. From acid to alcohol: some reduction will suffice. However, it was not that easy, since vitamin A acid is too sensitive and will disintegrate quickly. But the two Dutchmen were not to be dismayed. They came up with a new reaction, with which they produced vitamin A aldehyde. On 9 August 1947, Nature published a short article announcing the reduction of aldehyde to alcohol under mild conditions. The synthesis of vitamin A had been achieved!



### Isomers

The preparation created by Arens and Van Dorp is non-crystalline and only contains 35% vitamin. The rest are stereoisomers, substances with the same molecular composition but a different three-dimensional structure. This is caused by the fact that vitamin A has a side chain with 4 double bindings. Each double binding may have two forms, cis and trans. In principle, therefore, sixteen isomers are possible, while only one is the correct one.

[See next page >>](#)

## *Vitamin A*

Vitamin A was discovered as early as 1909 as a fat-soluble substance that is indispensable to life. In 1913, the substance was isolated and given the name of “fat-soluble factor A.” It was later discovered that the same substance occurs in the eye protein rhodopsin and is therefore crucial to eyesight. A lack of vitamin A causes night blindness. It also plays a vital role in the development of the skin. The structure was presented in 1931. It is actually not a real vitamin, because it is formed in the human body from betacarotene, which is therefore sometimes referred to as “previtamin A”. Betacarotene is a common substance in nature (it is found in carrots, tangerines, and green vegetables), which means that a vitamin A deficit will not occur in people who enjoy a varied diet. The daily allowance for vitamin A (a.k.a. retinol) recommended by the Dutch Nutrition Council is 2700-3300 IU (international units), the equivalent of 0.8-1 milligram.

## &gt;&gt; Vitamin A

The Chemisch Weekblad of 23 Augustus 1947 wrote: "A synthesis has now been developed for all known vitamins. Only vitamin A, whose structure was first known, had until now stubbornly resisted any attempts at synthesis. With fully justified national pride, we can now report that this final step in contemporary vitamin research has been taken by our compatriots Dr J.F. Arens and Dr D.A. van Dorp."

Several months later, researchers of Hoffmann-La Roche published an article in Helvetica Chimica Acta in which they described their synthesis, which does lead to pure, crystalline, vitamin A. This method appeared extremely well suited for upscaling, and Roche soon became the major producer of vitamin A. Organon never decided to manufacture vitamin A. The synthesis developed by Arens and Van Dorp includes several steps that are difficult to

carry out on a large scale. This would have required investments of several millions, and this kind of money was not available in the post-war Netherlands.

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Dr J.F. Arens and Dr D.A. van Dorp in 1948

## The storming of Bourtange

You will probably remember the trip to Bourtange on Sunday 7 July for a long time, not only because this centuries-old fortress looks as if it is still functional today but also because the past will turn out to be very alive in the present.

Bourtange is a beautiful little town near the German border. For centuries, it was used as a fortress. It is a typically Dutch fortress. The defensive capabilities of the water and the many swamps in the area were used to maximum advantage. Several star-shaped moats and walls surround Bourtange. The fortress saw active service from 1577 to 1851 and was part of a string of fortresses — Oudeschans ('schans' meaning fortress), Boonerschans, Nieuweschans — defending the vital city of Groningen against all attackers.

After 1851, the fortress lost its strategic value and the moats were filled in. The once impressive fortress turned into a peasant village. But not for all times! In the 1960s, a restoration of the fortress to its original state of 1742 was energetically undertaken. The builders were fortunate because they could use the original drawings. Some ten years ago, this drastic make-over was completed.

### Murder

As you will soon discover, the past is still alive in Bourtange. Do not be alarmed when you suddenly encounter some soldiers dressed in what must be very ancient battle dress. And what happens next ... will be explained on the spot. The students will be divided into teams. Each team has to find out as much as it can about the history



Bourtange

of Bourtange. Meanwhile, the teams should also solve a gruesome murder that occurred in the town some 400 years ago. Perhaps the strange characters lurking around in the fortress know more about this mysterious affair. Who knows, you might succeed in extracting some information from them. The team that plays the game most skillfully wins. Good luck!



## Tomorrows program

Sunday 07 July 2002

### MENTORS / SCIENTIFIC OBSERVERS

08:00 Translation Practical Examination  
13:00 Lunch at hotel  
14.00-17.00 Excursion Eernewoude (optional)  
19:00 Dinner at hotel

### STUDENTS

11:00 Instruction in Safety practices  
(in 2 rounds of 4 groups)  
12:00 Lunch at hotel  
13.30-17.00 Excursion Bourtange  
19:00 Dinner at hotel

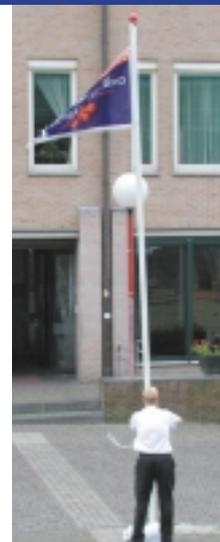
### GUESTS

13:00 Lunch at hotel  
14.00-17.00 Excursion Eernewoude  
19:00 Dinner at hotel

## Registration of the delegations



All delegations will be received and registered at the Academieggebouw. At times, things get a little hectic, but many hands make light work.



The flag of the Chemistry Olympiad is raised near the Academieggebouw.



Upon their arrival, the students and mentors are taken under the wing of their hosts. The Byelorussian delegation has already passed registration and has found its host.



Afterwards, there is still time for a nice lunch to recover from the journey.



Around 4 o'clock, students who have just received the latest Catalyzer (no. 4) occupy the steps of the Academieggebouw. If you have any interesting information, gossip, or other newsworthy item, please pass it on to one of the Catalyzer editors.

## In the limelight: The Chinese team



The Chinese team: Liu, Lu, Wang, and Zhu

The Chinese team arrived yesterday and has regained most of its composure, despite the time difference. They explain that jet lag is not so bad when you are traveling with the sun.

Their first impression of the Netherlands is positive: it is very clean here, and they are relieved that they have exchanged the clammy heat of China for more comfortable weather. That this comes with an occasional light shower does not bother them; on the contrary, they feel it is part of the ultimate Netherlands experience.

The members of this team go in for many hobbies: they are not only musically inclined, but they enjoy reading (History and Science), basketball, soccer (with the Netherlands and Brazil as their favorite teams), computer games, and swimming. Of course, the latter they can do in Zuidbroek at any time...

## Welcoming reception and dinner



All guests are welcomed by Jan Apotheker, the chair of the organizing committee. He hopes everyone will have a good time in Groningen and success in the Olympiad. That calls for a toast, of course.



The first time most of the guests get a taste of food in the Netherlands. Shrimps, mackerel, herring, and potato salad. But also rice and meat, of course, for those who do not want to start off too exotically.

## International Chemistry Olympiad gathering steam

The International Chemistry Olympiad is coming along nicely. Not only are the participants pouring in — it is now Friday afternoon — but the delegates of nearly all observing countries have also arrived. The worldwide appeal of the Olympiad is evident from the number of countries that have sent observers. This year, no less than eight countries are present in Groningen because they are considering to send participants to the International Chemistry Olympiad next year. The Arab Bureau of Education for the Gulf States does the honors for several countries simultaneously, among them the United Arab Emirates and Saudi Arabia.

The other observing countries are:

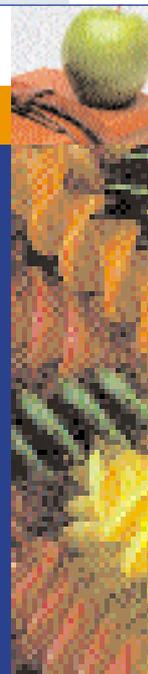
- Cote d'Ivoire
- Peru
- Japan
- Portugal
- Mongolia
- Tadzhikistan
- Nigeria

## What's on today's menu?

Saturday 06 July 2002

### Dinner Buffet at It Wiid

- Portuguese fish soup
- Crispy salad with French dressing
- Ham and pumpkin with a honey dressing
- Various types of breads with butter
- Lamb curry with risotto
- Couscous with mixed vegetables
- Spätzle with cream and mushrooms
- Chicken saté with dried onions and pickled cabbage Indonesian style
- Potatoes au gratin
- Steamed fillet of hake with lemon grass and a white wine sauce
- Tortellini with fresh tomato sauce
- Chocolate blancmange with blueberry sauce and cream



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Graphic design  
G2K designers, Groningen/Amsterdam



## Opening ceremony in the Martinikerk

Although the Olympiad had already taken off furtively on Friday, the official opening ceremony took place yesterday, in the Martinikerk in the center of the city of Groningen. After a musical contribution by the Frysk Wind Ensemble, the president of the 34th International Chemistry Olympiad, Wout Davids, welcomed the participants, mentors, and guests. In his speech, he also thanked industry, the city council, and the university for their support. He likened them to the pillars of the house that is the IChO. "Old Grey" concluded with these wise words: "There is still a lot to discover in Chemistry, both with our hands and with our brains."

After this word of welcome, all countries were presented. One member of each delegation carried the flag of their country to the rostrum. After greeting the audience, they placed the flags side by side in the flag stands.

After a musical interlude, the Rector of the University of Groningen, Doeko Bosscher, addressed the participants. He invited all these up-and-coming top chemists to come and study in Groningen next year.

See page 3 >>



The flags in the Martinikerk

## Fifty years of goat's milk production

Life without polymers is hardly imaginable nowadays, but these substances have only become plentiful after the Second World War. In 2002, DSM celebrates the 50th anniversary of its manufacture of caprolactam, the raw material for nylon. DSM, a Dutch multinational company, is the current world market leader in the manufacture of this best known of all polymers. Literally, "caprolactam" means "goat's milk."

There have probably been few inventions whose first application was so conspicuous as nylon. On the eve of the Second World War, the nylon stocking — based on an invention by W.H. Carothers, an American chemist employed by the DuPont chemical company — made the nylon polymer world-famous overnight.

Carothers made his discovery when searching for synthetic macromolecules that would have similar properties as wool and silk. In 1930, his



research led to the discovery of substances characterized by an amide link between the monomer components: the CONH link. This link occurs in many natural substances (polypeptides), for example hairs and muscle fibers, but also in hormones, tendons, and structural materials. Starting

from  $\epsilon$ -aminocaproic acid ( $\text{NH}_2 - (\text{CH}_2)_4 - \text{COOH}$ ), he created a polymer which — when used with a new spinning technique — could easily be made into long fiber strands. In a later stage, hexamethylenediamine and adipic acid were used as basic materials:

See next page >>





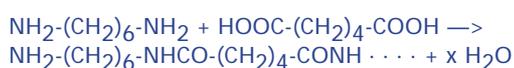
## In the limelight

## Japanese observers

The three Japanese observers Atsunori Mori, Masato Ito, and Yoshihiko Noda have just arrived in Eernewoude, where the mentors, observers, and guests will stay next week. They are positive about the IChO: it is an exciting event that appears much bigger now than they had imagined back in Japan. The various pieces of music during the opening

ceremony, and especially the vocal intermezzo, were also very impressive. They praise the laboratory for the practical exams: it is very spacious and clean. Japan already has a national Chemistry Olympiad. The first round will take place at the end of July with around 1250 students participating, the second at the end of June with the 60 qualifiers from the first round. In 2003, Japan will participate in the IChO for the first time.

### >> Caprolactam



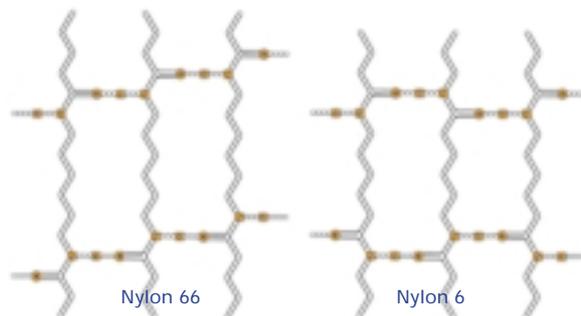
At roughly the same time American chemists were developing nylon, Dr Paul Schlack of IG Farben in Germany succeeded in creating a similar product (on 28 January 1938). This polymer was given the name of Perlon; it is currently known as nylon-6. Schlack used  $\epsilon$ -caprolactam as his basic material. This substance had been produced for the first time in a laboratory forty years earlier, in 1899.

Nowadays, caprolactam is produced by converting cyclohexane or phenol via cyclohexanon to cyclohexanonoxim and then heating this intermediate in sulphuric acid. This chemical reaction is known as the "Beckman rearrangement."

The name "nylon" currently designates a whole range of materials. Each of these products is characterized by a number at the end of its name. Nylon 66 is the name of the product first marketed by Dupont in 1939; it is still the main type of nylon produced in the United States. Conversely, manufacturers in Europe — among them market leader DSM — produce high quantities of nylon-6. Worldwide, too, nylon-6 is the "biggest" nylon, with a market share of 60%. All nylons-X have been manufactured, from nylon-2 to

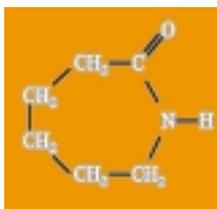
nylon-11. Some of the properties in which they differ are their melting points and the way in which they absorb moisture. The main properties of all nylons are high tensile strength, high melting point, environment-resistant, elastic, low moisture absorption, and low density.

Apart from stockings, the first applications of nylon included toothbrushes, tents, and



ropes. In wartime, nylon soon became popular with manufacturers of parachutes. Both the parachute fabric and the parachute ropes can be made of this light and strong material. Parachutes left behind by paratroopers in war zones were gratefully recycled and turned into clothing by the destitute population. Nylon is currently unrivalled in its number of applications, which included textiles, carpets, industrial fibers, engineering plastics, and film.

The current interest in sustainable usage, incidentally, has brought the possibilities of recycling nylon-6 to the fore again, since in principle nylon-6 is fully recyclable. One example of the reuse of nylon-6 is the recycling of carpets. It is possible to reclaim the raw material caprolactam from old carpets. DSM has even opened a carpet-recycling factory in the United States. The company has also developed a logistic system for the collection and transportation of these carpets. In the long term, it may be that more caprolactam will be obtained from renewable sources. And who knows, maybe this raw material for nylon will one day be as environmentally friendly as real goat's milk.



Caprolactam

## Tomorrows program

Monday 08 July 2002

### MENTORS / SCIENTIFIC OBSERVERS

09.00-10.00 Breakfast at hotel  
10.00-16.00 Lake-tour Friesland  
16.00-1830 Consultation with authors  
Theoretical Examination  
19.00 Dinner at hotel  
20.00-24.00 Second Jury Meeting

### STUDENTS

07:00 Early breakfast at Hotel  
08:00 Departure for Groningen-University  
09.00-14.00 Practical Examination  
16.00-17.30 Sport activities  
17:30 Departure for Zuidbroek  
18:30 Dinner at hotel  
20:00 Lecture on Chemistry

### GUESTS

09.00-10.00 Breakfast at hotel  
10.00-16.00 Lake-tour Friesland  
18:00 Dinner at hotel  
19.00-23.00 Excursion to Nij Beets

## >> Openingsceremonie



Wout Davids

Fortunately, he realized that their home countries also need them badly! The mayor of Groningen, Jacques Wallage, stated that Groningen has a long tradition of international openness. After hosting the Paralympics and the start of the Giro d'Italia just recently, Groningen now has the privilege to welcome the Chemistry Olympiad in its midst. He seconded Mr Bosscher's idea that "however important science is, you should also enjoy yourself once in a while." Prof. Zwanenburg, the chair of the Scientific Committee of the 34th International Chemistry Olympiad, explained that he felt it both an honor and a challenge to draw up the tests for the IChO. These assignments will be highly appropriate to the motto of the 34th IChO: "Chemistry and the quality of life go hand in hand."

Jan Apotheker, the chair of the organizing committee, then invited the captain of the Dutch delegation, Hendrik Moons, to take the Pledge of Academic Conduct. To conclude the ceremony, he opened the 34th IChO officially by raising the flags.

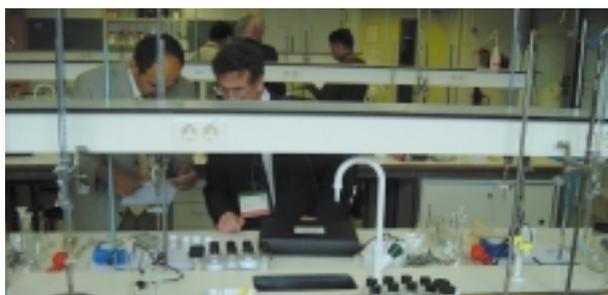


Jan Apotheker en Hendrik Moon

## Laboratory Inspection



The mentors of the participating teams have inspected the laboratories to check if everything is ready for the practical examinations of their teams.



The lab setups seem challenging, to say the least, but will hopefully also appeal to the students who will have to use them on Monday...

## Domino

In the evening, the delegations use the videocassettes to set up a domino project that will be a symbol of their country. As can be expected, things do go wrong occasionally...



Besides these national projects, all teams join hands to create a masterpiece for the grand finale. Highly conducive to integration, of course...



...and this is the final result!



## The youngest participant



Gabriël Isar is 6 months old and without doubt the youngest IChO participant; he is Iceland's secret weapon.

## The motto of the 34th IChO

Chemistry is not just an activity undertaken in laboratories. No, chemistry is everywhere. Anyone interested in chemistry will certainly agree to this, and the scientific committee wants to draw people's attention to it. That is why the motto for this Chemistry Olympiad is:

*Chemistry and the quality of life go hand in hand.*

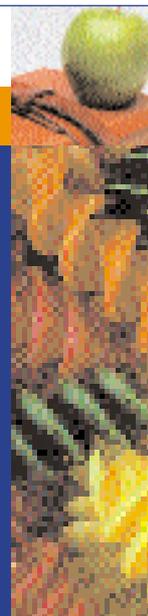
This motto is the central theme running through the Olympiad. It will also return in the assignments, because chemistry and (everyday) life can simply not be separated.

### What's on today's menu?

Sunday 07 July 2002

#### Dinner Buffet at It Wiid

- Argentinian curry soup
- Various types of breads with butter
- Carpaccio of beef with Parmesan cheese
- American potato salad
- Cucumber salad
- Baked beans Argentinian style
- Stir-fry ostrich with okra
- Baked potato
- Vegetarian dish of the day
- Wild rice
- Cannelloni with spinach
- Veal escalopes in tomato sauce
- Apple pie with ice cream



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Monday 8 July 2002

Issue no. 7

Journal for the 34th International Chemistry Olympiad | Groningen | The Netherlands | 5 - 14 July 2002

Jan Willem Kok,  
sector manager Water Management

## *H<sub>2</sub>O management and chemistry*

It is well known that the Netherlands is built in and from the water. The country is situated in the estuaries of many great rivers: the Rhine, the Meuse, and in the north the Ems. And, of course, a sea forms a major part of its borders: the North Sea. Moreover, many parts of the country are situated below sea level. Water — H<sub>2</sub>O — galore, therefore; a liquid that must be managed every day, with chemistry because of its chemical properties.

The Netherlands is divided into “waterschappen.” These districts water boards are functional government agencies commissioned to manage the water within their boundaries. They are responsible for water management, both qualitatively and quantitatively. They are also responsible for the sea dikes. Every day, these water boards ensure that Dutch citizens do not get their feet wet and that the water in the ditches and canals remains clean.

What, you may ask, does this day-to-day water management have to do with chemistry? Well, a lot!

### **Water quantity management**

To begin with, the water in this case is not simply H<sub>2</sub>O, i.e. pure distilled water; no, it contains many additions. It holds much organic material, for example, which will give trouble eventually. This organic material will enter the water, for example, because the Dutch soil in many places contains much peat. Suspended peat particles will quickly bind chemical substances. When heavy enough, it will sink to the bottom of the ditches and canals as sludge. This sludge must be removed at regular intervals, because it obstructs the supply and discharge of water. The water boards have a great sludge problem, both under water on the bottom of the watercourses, and on land. The Netherlands, therefore, has many sludge depots. Essentially, these may often be characterized as major chemical dumping grounds. Many of these depots are a great burden to the environment. For this reason, they must be insulated to prevent pollution of the groundwater. Sometimes they must be decontaminated. In short, they are a chemical point of attention.

## *Subsidence due to gas extraction*

The presence of natural gas and oil under the Dutch soil has made a significant contribution to the birth and flowering of the Dutch chemical industry. But gas extraction has also had a different and remarkable effect in Groningen. It has caused the land

– often already lying below sea level – to subside even more. How is this possible? The gas is contained under high pressure in porous rock layers deep underground. As soon as the gas is being extracted, the pressure in the emptying reservoir will gradually begin to decrease. When this happens, the pebbles of reservoir rock will become slightly compressed by the weight of the layers on top of the reservoir. The degree of subsidence



The large pumping station ‘Rozema’ near Termuntenzijl

depends, among other factors, on the drop in pressure, the composition and porosity of the rock, and the thickness of the reservoir. A measurement made in 1998 showed a maximum subsidence of 23 cm. According to the prognoses, this will increase to around 45 cm in the year 2050. In a flat country, several tens of centimeters of subsidence will have such an impact on the soil hydrology that, for example, several

pumping stations will have to be built to counter these effects. The large pumping station in the photograph above, situated near Termuntenzijl, is one of them. It pumps water from the polder into the Wadden Sea. Besides gas extraction, other causes of subsidence may be, for example, the settling of clay and peat layers, the lowering of the groundwater table, and oil and salt extraction.

### **Water quality management**

As we have seen, it is not distilled water we are concerned about. The district water boards do not supply (drinking) water either. However, they are responsible for the purification of waste water. After the various municipalities have collected the waste water in their sewer systems, the district water board transports this polluted water through large

pipes to one of the many purification plants. The every-day use of water in private homes, in the street, and in factories pollutes it all over again with organic material and other chemicals. In the purification plants, all this water is purified with biological processes. Bacteria and much oxygen are used to purify the

See next page >>

## No day off for mentors on Sunday

Saturday evening and Sunday were particularly hectic times for the mentors. The assignments for the practical exams they were given gave rise to an hours-long debate about the exact formulations of the assignments, the marking regulations, and the marking weights. When a persistent difference of opinion could not be overcome by talking about it, the representatives of the participating countries voted by holding up a red or green card; the decision was then taken by majority vote. Because the chair was strict but fair, these discussions could fortunately be concluded well within the appointed time frame, and the translation stage could begin. The mentors are expected to translate the (English) master document into the native



language or languages of the students in their teams. For this purpose, 60 computers had been deployed throughout the holiday park.

Intensive use was made of these machines until the small hours of the night and again from early in the morning into the day. For the mentors of several countries with English as native language, this translation stage was relatively easy. They were free to explore the countryside on foot, by canoe, bicycle, or sail boat.

### >> Water management

waste water. Sometimes this process has to be supported with additives, for example to increase the water's acidity. After a long series of bacteriological treatment, aeration, and sedimentation steps, the water has for the most part been purified while the pollutive chemicals have settled in the sludge. The result is clean water and, once more, polluted sludge. In the past, this sludge was used as fertilizer in agriculture but it is now too polluted to be spread on the fields. The purification sludge is now processed with various alternative methods, for example drying, burning, storage in old mines, and using it as raw material for cement.

The district water boards do more than taking care of the quality of the (communal) waste water. They also monitor the quality of the surface water on a daily basis. Surface water is polluted by all kinds of natural processes, but often even more so by human activities. These activities — often industrial in nature — release many substances that pollute the water, either directly or diffusely. Through a permit scheme and a monitor system, the water board keeps an eye on the direct chemical pollution of the water. Various European and national regulations will help to push back the more diffuse chemical pollution also. We have come a long way in this respect in the Netherlands, but is still not the case that we can drink from any ditch without running serious health risks. Nature also suffers from this sub-standard water quality, since the water is still



Helophyte filter.

too polluted with phosphates, nitrogen, zinc, copper, and crop protection chemicals. The main sources of this pollution are intensive agriculture, the building industry, and the water mains network. Together with industry, agricultural organizations, and the population at large, we expect to push back chemical pollution, so that in the near future — even more so than today — we may truly speak of H<sub>2</sub>O management in this low-lying, damp little country of ours.



## Tomorrows program

Tuesday 09 July 2002

### MENTORS / SCIENTIFIC OBSERVERS

08.00-17.00 Translation Theoretical Examination  
19.00-23.00 Frisian evening

### STUDENTS

07:00 Early breakfast at hotel  
08.00-17.00 Excursion 'Water Management and Chemistry'  
19:00 Dinner at hotel

### GUESTS

08:00 Breakfast at hotel  
10.00-19.00 Excursion in Friesland  
19.15-23.00 Frisian evening

## Trip to Bourtange



Team purple-blue discussing tactics

Yesterday afternoon, all IChO students played a kind of living Stratego in this authentic fortified town. The starting signal, a canon blast, was given by a member of the "a little bit Dutch team", South Korea. In four teams (split up into two subteams), they then had to answer the question "What is the Fifth Direction of the Wind?"

### Puzzles

They could extract tips from a soldier, a lieutenant, a minstrel, a mill boy, and a monk who all happened to be in town. They also had to solve puzzles and carry out assignments in small groups. However, any team member was always in danger of being "taken out" by a member of another team with a higher rank. This could earn the teams points. In short, it all came down to the right combination of cooperation, communication, and competition. The final assignment involved the joint building of an amphitheater with wooden poles and ropes. In the amphitheater, it finally became clear what the "Fifth Direction" was. Each team was asked to answer the question and present arguments for their answer. One team had the correct answer: the Fifth Direction is within you. The argument: a group can achieve a lot if all members move as one in the same direction, as the afternoon's game had shown.



Questioning the lieutenant



Building the amphitheater

## Girls (and boys) from Thailand, Norway, and Kuwait

A quick count of the names published in Catalyzer 4 shows that only 20 % of the students is female. The more striking, then, that there are three teams with three girls and one boy. The teams from Norway, Thailand, and Kuwait therefore had to have a group photograph taken of them

all together. These teams, and particularly the boys, themselves also felt that they were a bit special. The teams really did not know what to expect, but so far they have enjoyed the Olympiad tremendously. Especially the Dominoes game of the day before



yesterday was much appreciated. One girl on the Thailand team had also participated in last year's Olympiad in India. So far, the Netherlands compare well with India, she told us, but sadly it is very cold here!

## Did you know that...

- The Byelorussian host expects his team to win five silver medals.
- The Mexicans are rapidly making friends with delicious tequila candy (highly recommended).
- Sam Salman (Australia) can be reached after the Olympiad at saamsal@hotmail.com.
- The Catalyzer Press can be found in rooms 124 and 130 in Zuidbroek.
- A flip-chart will probably be available as of tonight so that you can react to questions or propositions we want to put to you.

## Safety instructions

To ensure maximum safety during the Olympiad, all students have been instructed on Sunday 7 July on how to work safely in the laboratories. They have also been instructed on what to do if a calamity should occur. This was done in two rounds with four groups of students each. Students are to abide by the following regulations:

- Wearing safety glasses or goggles and a lab coat is obligatory.
- Sandals and open shoes are prohibited; only closed shoes are allowed.
- Students are to wear a long skirt or full-length trousers.
- Long hair must be done up.

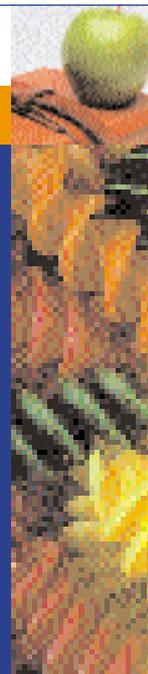
In the case of a first violation of the safety regulations, the student concerned will receive a warning. A second violation will result in exclusion of the student.

## What's on today's menu?

Monday 08 July 2002

### Dinner Zuidbroek

- Fish: fillet of hake or cod parings
- Meat: chicken drumsticks
- Vegetable: cauliflower
- Pasta with sauce (also vegetarian)
- Pilaf rice
- Cream potatoes
- Russian salad
- Salads with a variety of dressings



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Milieuwet 1991 Uitvoering Cultuur en Waterschappen



34<sup>th</sup> International  
CHEMISTRY OLYMPIAD

Groningen | The Netherlands | 5 - 14 July 2002



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## *The first hurdle has been cleared*

Yesterday morning the moment of truth had finally come: the practical exam. Somewhat tense, the students got up early to be transported to the laboratories of the Faculties of Chemistry and Pharmacy. For five hours, the contestants had to display their practical skills to their best advantage. Three interesting and challenging assignments had been set for this purpose. In the adjacent interview, you can read more about the background and content of these experiments.

At a quarter to three (!), the first students came out of the laboratories. They were visibly tired and sometimes you could not get a word out of them. After consumption of some rolls and beverages, they slowly came to their senses again and began to compare notes. The reactions were mixed: some had finished well before the appointed time, others had kept on working until the last minute. The general opinion was that they had had to work hard but that the assignments had not been too difficult. Although the work was now done for the students, the



scientific committee had their work still cut out for them: in the coming days, they will have to check and assess all melting points, TLC plates and weights...

## *Interview with Prof. B. Zwanenburg, chair of the scientific committee*



'When formulating the assignments for the practical exam, the scientific committee kept its eye on the theme of "Towards the greening of Chemistry." This theme is highly relevant nowadays, particularly within industry. Chemical companies are increasingly paying attention to the selectivity of reaction steps, the responsible use of solvents, and the costs and benefits of chemical process steps. The theme formed the inspiration for the three experiments selected for the exam. In one of these, the students were asked to synthesize a substance used as a basic substance for therapeutic drugs. The starting substance was the amino acid phenylalanine.

Ordinary water was prescribed as the reaction medium, instead of an environmentally unfriendly solvent. This was not only appropriate to the theme, but also increased the safety of the experiment.

Staying within the domain of health care, the next assignment involved the analysis of iron pills to determine their quality as a drug. This required the use of spectrophotometry, one of the most up-to-date chemical analysis techniques. One of the latest developments within the "greening of Chemistry" is the use of stereoselective natural enzymes. By starting from a racemate, this technique enables the production of an almost pure stereoisomer as final product. The students had to study the effects of such an enzyme. An example from bulk chemistry is the production of aspartame, which DSM produces with similar enzymes.'

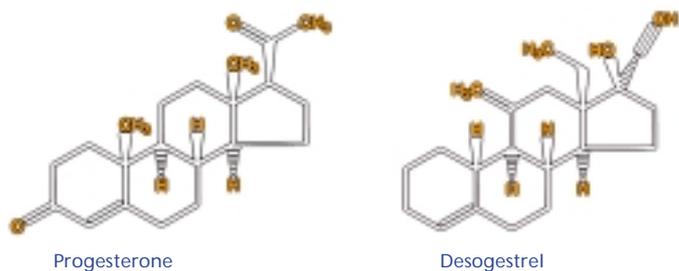
## *Trip to Amsterdam*

Day two of the Olympiad competition. Who will find the correct solutions and be awarded the prizes on Saturday? The competition will be fierce and tight. But while the students will join in the fray — good luck, youthful contestants! — the mentors will have the day to themselves. A trip to the Dutch capital Amsterdam is in store for them, a trip that the students will only make on Friday.

Amsterdam is a city that does not lend itself well to a summing-up. The city is simply too diverse for that: more than 700,000 inhabitants, 400,000 bicycles, 10,000 shops, 165 canals, 1300 bridges, 2500 houseboats, 40 museums, 7000 historical buildings from the sixteenth, seventeenth, and eighteenth centuries, 40 concerts and shows each day, 1400 pubs

## The pill with more impact than an atom bomb

It was not Einstein's relativity theory, nor the atom bomb, nor the power of computers or the birth of the Internet that had the biggest impact on life in the previous century, two hundred prominent historians conclude in a retrospective. Instead, they regard the introduction of the contraceptive pill in 1960 as the most influential event. Although the pill was never used as a matter of course in its early days (as it still isn't today), the consequences of its introduction were enormous. The "anti-baby pill" finally separated sex from reproduction, and this led to a drastic reduction of the birth rate in many countries. The pill became one of the symbols of the social changes occurring in western countries in the 1960s. Today, around 100 million women take the pill every day.



What exactly is it, this pill, and how was it developed? One of the first steps was taken in 1901, when it was demonstrated that menstruation is regulated by hormones. In 1936, American scientists showed that the progesterone hormone can inhibit ovulation. It is this substance which the "father" of the pill, American Gregory Pincus used in the first trials with 60 female volunteers. In the same year, Pincus carried out the first large-scale trial with 6,000 participants in Puerto Rico and Haiti — and it was a success. American pharmaceutical company Searle began to market the first contraceptive pill — Enovid — in 1960.

### Organon

Dutch company Organon (a subsidiary of Akzo Nobel) has always been in the forefront of the pill's development. The company has many years of experience with hormones. As early as the 1930s, it marketed fertility hormones for women. In the 1950s, the Organon laboratories discovered a substance that strongly resembles progesterone, a 3-deoxo-steroid. Two years after Searle, Organon therefore introduced its own pill, Lyndiol, which contains Lynestrenol, the 3-deoxo-variant of norethisteron, the main component of the Searle pill.

### Second generation

The first pill generation was followed by a second. This pill contained less progestatives, which reduced the number of androgynous (masculinizing) side effects. Searle researchers succeeded in this by introducing substituents on several positions in the steroid molecule: 11-beta-methyl-19-norsteroid.

To find an answer to the introduction of this improved pill, chemist Albert Joannes van den Broek of the Organon organic chemistry laboratory began a search for a variant of the 3-deoxo-steroid with similar properties. For this purpose, he introduced an oxygen atom at position 11 of the steroid molecule. He then tried to convert the 11-oxo group into a beta-methyl group. To accomplish this, Van den Broek reasoned, a so-called Grignard reaction with methyl magnesium bromide or methyl lithium seemed the most likely candidate. This would result in an 11-hydroxy-11-methyl system, with the 11-hydroxyl group still to be removed. However, this proved difficult because the orientation of the 11 methyl group was difficult to control, and the reaction often resulted in a mixture containing 11-alfa-methyl — a substance which, although pharmacologically inactive, is difficult to remove. Because of this problem, Van den Broek opted for a different approach. He used Wittig reagent (triphenyl-methylenephosphorane) to convert the 11-oxo group to the 11-methylene group. Then, he reduced the methyl group catalytically with stereoselective hydrogen to the 11-beta methyl group. Van den Broek had the hormonal properties of various 11-beta methyl steroids tested. He also sent the lab some 11-methylene intermediates to be tested, among them desogestrel. To everyone's surprise, the latter product proved to be the substance Van den Broek had been looking for. It became the basis for Marvelon, a pill that is now used all over the world.

### The "male pill"

When it was introduced, many women saw the pill as an instrument liberating them from the "plight of pregnancy." The women's rights movement received an enormous boost. However, not all users of the pill were happy with it. By the end of the 1960s, complaints were heard about the "hormone corselet" women had to squeeze into and about possible health risks. Some feminists complained about the unequal division of pleasure and pain between men and women: she takes the pill and hopes to stay healthy, he doesn't take anything and is not worried at all. So far, men seem little inclined to take a variety of the pill.

Nevertheless, the World Health Organization doggedly continues to develop a male pill. Perhaps it will be a female chemist who will discover it, who knows? In the meantime, the pill will remain a daily ingestion for women in many parts of the world.



## Tomorrow's program

Wednesday 10 July 2002

### MENTORS / SCIENTIFIC OBSERVERS

07:00 Early breakfast at hotel  
08.00-22.00 Excursion to Amsterdam  
and surroundings

### STUDENTS

07:00 Early breakfast at hotel  
08:00 Departure for Groningen University  
09.00-14.00 Theoretical Examination  
15:00 Departure for Zuidbroek  
18:00 Dinner at hotel  
19.30-01.00 Evening out in Groningen

### GUESTS

07:00 Early breakfast at hotel  
08.00-22.00 Excursion to Amsterdam  
and surroundings



After the practical exam, the students could relax by singing, dancing and drumming together.

**“Why did you make the practical examination best/worst?”**

- *“Was very good”*  
– Yuri (Brasil)
- *“Well... life isn't always fair... and certainly, practical exam is part of life!!”*  
– Patrick (Canada)
- *“Traditionally bad”* – Greece
- *“During the practice there were the calmest minutes during these few days, so I used them for resting... And it was too late then...”*  
– Paulius (Lithuania)
- *“The UV spectrometer fooled me – I thought it was the weighing balance”*  
– Martin (Ireland)
- *“No comment”* – @%\$U\_&Y (difficult to copy these Arabian characters)
- *“Vacuum filtration devices should have been more”*
- *“Yes, definitely!”*  
– Slim/Estonia



## >> Trip to Amsterdam

and bars, and 750 restaurants. The itinerary for today contained nothing but highlights. The trip by boat through the famous canals is not to be missed. It will probably offer the most intense experience of the rich past of this city. Another highlight will be the Rijksmuseum with its internationally renowned art collection, including hundreds of paintings from the hey-day of the city during the Dutch “Golden Age” (some 300 to 400 years ago). The collection contains many works by Rembrandt — among them, of course, the famous “Night Watch” — and Vermeer. Try to evade the hustle and bustle that always accompanies this kind of trips for a few minutes and



Rembrandt: “Night Watch”

take this time to let some of the paintings of these grandmasters really get to you. You will be rewarded. A completely different experience will be the visit to Nemo, a science and technology center in the heart of Amsterdam. In this ultramodern architectural masterpiece by famous Italian architect Renzo

Piano, the visitors can conduct chemistry and physics experiments themselves. Always nice, of course, for you to critically examine the chemistry experiments on offer. And, if the overcrowded program lets you, try to experience a whiff of ordinary life in Amsterdam. No doubt, you will be struck by the extraordinary mix of people. On the way back, there will be dinner at a typically Dutch restaurant in Volendam. The journey back leads through the “polders”, land that used to be the seabed of the former Zuider Zee; if there is still time, the Batavia will be visited, a replica of a 17th-century VOC merchantman.

Have fun!

## Touring the Friesian lakes



After all the excitement and effort put into the translation of the practical exams, the mentors were given ample opportunity to relax during the "Lake tour Friesland" on Monday, a six-hour boat trip around some of the lakes of Friesland. Before the trip, they were treated to a lecture about the many aspects of water management in Friesland. On the way, the boat made a quick stop at Grouw, the picturesque tourist town with its cozy, traditional shopping alleys. By the end of the day, everyone had more or less replenished the energy spent on Sunday and regained their breath for the next challenge: the translation of the theoretical exams.

## Accident observer

MONDAY 8 JULY: Although the Martinikerk was packed with students, mentors, and guests last Saturday, we were unfortunately not able to welcome Mr Kingsley Imade from Nigeria in our midst. Because of a car accident in Nigeria, he could not attend the opening ceremony of the 34th International Chemistry Olympiad in Groningen. Mr Kingsley Imade was to visit Groningen in his capacity as observer because Nigeria is considering Olympiad participation next year. We wish him all the best.

## Did you know that...

- Several guides are lending a hand as part of an internship. And, rumor has it, this is the best internship they have ever had!
- A Polish lab assistant helping the students attended the same secondary school as one of the Polish contestants.
- The Australians claim that they saw New Zealanders "jumping halfway over sheep."
- Herman Broek (IChO coordinator): "We'll probably create a new problem for any solution we may find."

## What's on today's menu?

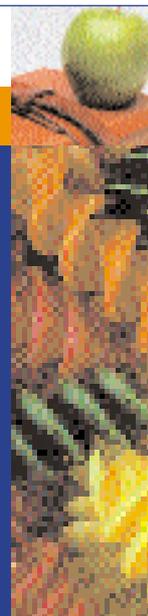
Tuesday 10 July 2002

### Dinner Zuidbroek

#### Indonesian buffet with:

- Ayam Bali (chicken Bali)
- Babi Ketjap (Pork in black sauce)
- Fried yellow rice
- Rendang (Spicy coconut beef)
- Beans "Sambal Goreng" (spicy and stir fried)
- Sayur Lodeh (Curried stew)
- Chicken Madras
- Salads with dressings

Many thanks to the Zuidbroek chef!



Mallinckrodt Baker



34<sup>th</sup> International  
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Wednesday 10 July 2002

Issue no. 9

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## *From solar panel to power paint*

The lecture on Monday evening was given by Prof. Kees Hummelen. After studying Chemistry at the University of Groningen, he worked for four years as a jazz pianist, before returning to Chemistry as a post-doctorate researcher. For some ten years now, he has been professor of Material Chemistry in Groningen.

Solar cells have been in use for quite some time, not only in the well-known solar panels on roof tops, but also as a power source for ultralight aircraft and the electric cars that participate in special races in Australia. "The most useful application must be the refrigerated transport of medication on the back of a camel," says Hummelen. "However, the basic material (silicon) can no longer be produced in sufficient quantities to meet the ever-increasing demand. For that reason, more and more research is done to investigate organic chemical alternatives."

See page 3 >>



Professor Kees Hummelen

## *Glare: indefatigable panels for the largest aircraft*

In the year 2006, the first Airbus A380 aircraft should roll off the production line. This gigantic aircraft will be able to carry between 550 and no less than 800 passengers, at a price per passenger that is 20% lower than that of the largest aircraft of competitor Boeing. To achieve this goal, the A380 should be as light as possible and as cheap to maintain as possible. For this reason, the most advanced materials and technologies will be used in its construction.

One of these materials is Glare (GLAssfiber REinforced), a material that has been under development for more than 20 years at the Faculty of Aerospace Engineering of Delft University of Technology.

The 1-mm thick Glare panels consist of a sandwich of alternating layers of fiberglass and aluminum that are bonded together. In comparison with aluminum, of which most aircraft are constructed, Glare has several big advantages. It is lighter, cheaper, stronger, more fire and damage resistant, and less fatigue-prone.



### **The entire fuselage**

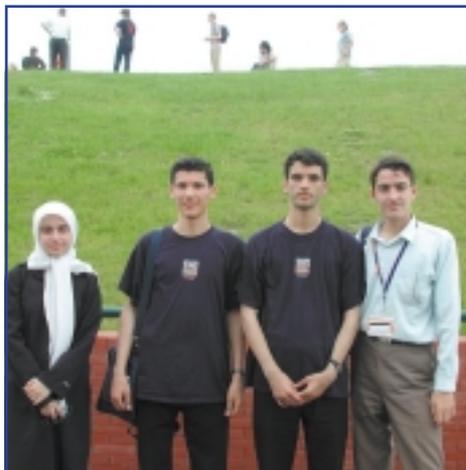
It is to be expected that each Airbus A380 will use around 380 square meters of Glare in its skin, mainly towards the front and rear of the cabin section. Thus, the aircraft will be around 800 kilograms lighter than with an all-aluminum body. Because this is the first time that the material will be incorporated in an aircraft on such a large scale, the manufacturer does not yet want to use Glare for all kinds of components. The application of Glare in the central section of the fuselage, where load stresses will be at their highest, will be avoided.

However, this may change in subsequent aircraft designs. Engineers at Delft are currently studying the preliminary design of the latest Airbus passenger aircraft, the A3XX. The manufacturer is now considering the use of Glare as the primary material for the fuselage. Thus, the A3XX may become the first aircraft with a fuselage completely constructed from Glare.

### **Convertible**

Glare has been mainly developed to combat fatigue, so that it would be safer than aluminum and would not require

See next page >>



## In the limelight

## Team Iran

As some people will probably have noticed, the team from Iran has a fifth member, Mrs Ghabel Rahmat. As an adult women, she acts as supervisor of the female student participating in the IChO, because the Iranian culture requires this. So far, she likes the Olympiad very much, she says. Much can be learned from the — sometimes

major — differences between the various cultures. Unfortunately, the Iranian team cannot join in all activities. They could not participate in the dancing, for example, and they have to watch what they eat. Their guide helps them with these matters. Luckily, the team has found its way within the Dutch culture of the Olympiad. Mrs Ghabel Rahmat states that she likes it here just a little bit better than last year in India.

### >> Glare

frequent inspection. An aircraft's wings and fuselage have to endure many and varied forces during takeoff, flight, and landing. The upward air currents required for takeoff will bend the wings upwards, while they will bend back again at the end of the flight, after landing. During takeoff, the fuselage of an aircraft is pressurized, so that the

passengers can keep on breathing. During descent, the reverse process takes place. All these changing stresses may lead to cracks in the material, which will become bigger after each change. Usually these metal fatigue cracks will be found during inspection before the situation becomes

critical. Sometimes things go wrong, however, as for example in 1988, when a major part of the fuselage of a Boeing 737 was ripped away and the plane had to continue its flight as a convertible, to the horror of the passengers.

### Impact damage

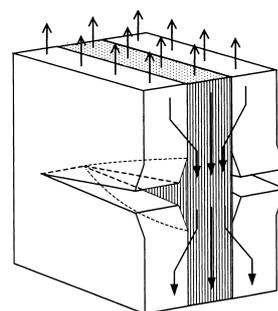
A big advantage of Glare is that it prevents metal fatigue cracks from getting bigger, because there is a layer of glass fiber sandwiched between the aluminum layers. These fibers are capable of keeping the material together — even under substantial stresses — and prevent tearing. Although fatigue cracks may also develop in Glare, therefore, the construction will then still be able to bear the maximum load. Even with cracks, the aircraft can remain in the air. To prevent any cracks still occurring for whatever reason from suddenly and explosively becoming major tears, an extra thick glass fiber layer has been provided every seventy-five centimeters. This will keep the problems created by larger

tears under control. The airworthiness authorities and aircraft manufacturers consider tears of up to one and a half meters as damage that should not cause an aircraft to crash. Besides fatigue, corrosion and impact damages are also threats to aircraft. Glare is hardly bothered by corrosion, however. The corrosion that occurs is limited to the outer aluminum layer and is stopped by the first fiber layer, which is covered with a metal adhesive that is insensitive to such influences.

Thus, the major part of a Glare panel will remain intact and durable. Impact damage is caused by hailstones, birds colliding with the fuselage at high speeds, stones thrown in the air by the undercarriage, pieces of metal lying on the runway, or airport carts colliding with the aircraft. The glass fiber layers are so strong that such impacts will do much less damage. This will reduce repair costs and increase safety.

### Forty meters in circumference

The aluminum layers in Glare have a maximum width of 1.6 meters, while the fuselage of the A380 will have a circumference of no less than forty meters. To prevent the application of large numbers of rivets to connect these comparatively small panels, so-called "splices" have been developed. In a splice, overlapping aluminum panels are glued together, in such a way that the glass fibers will extend without interruption. This creates very big Glare panels without the material losing its strength. The A380 will therefore be constructed with many less joints than conventional aircraft. Fokker Aerostructures in Papendrecht will supply the panels for the new Airbus.



The fibers are capable of keeping the material together and prevent tearing



## Tomorrow's program

Thursday 11 July 2002

### MENTORS / SCIENTIFIC OBSERVERS

07:00 Early breakfast at hotel  
 whole day Marking examinations or:  
 09:00-16:00 Excursion, among others 'Skütsjesilen'  
 19:00 Dinner at hotel  
 20:00-24:00 Third Jury Meeting (Business)

### STUDENTS

08:00-10:00 Breakfast at hotel  
 13:00-20:00 Excursion 'Mega Olympic Games'

### GUESTS

08:00 Breakfast at hotel  
 09:00-16:00 Excursion, among others 'Skütsjesilen'  
 19:00 Dinner at hotel



## Water management day



On top of the outer dike of the Breebaart polder

Around 15% of the Netherlands lies below sea level. The entire Tuesday was therefore reserved for the "Hunze en Aa's" district water board, which explained to the students how the Dutch population is protected against the sea. Secretary director Jacob Gunter and sector manager Jan Willem Kok began the day with an explanation of the duties of the Dutch district water boards. More information about this topic can be found in Catalyzer 7 and the info folder. After their talks, it was time for the excursions. Unfortunately we, the Catalyzer reporters, could only go with one of the buses.

The first destination was Teijin Twaron in Delfzijl, where Ate van der Werf, the assistant plant manager, explained the production process of PPTA (poly(paraphenylene terephthalamide)) used at the plant. He also fielded the critical, chemical questions of his audience quite successfully. After a trip around the plant, we were taken to the Rozema pumping station for lunch. For some of those present, this was their first opportunity to watch the sea at close range.

After lunch, the group went for a walk in the nearby Breebaart polder. This polder marks the border line between salt and fresh water and has a controlled tidal

system. This has turned the polder in a unique nature reserve, which has evolved here since the late 1970s. Standing on the outer dike, the students looked across the salty estuary. Several dozen seals

stared back.

After returning to the Rozema pumping station, the students were shown a short film about the reasons for the existence of this facility. Then, they could



One of the Teijin Twaron plants

## Last wishes before the theoretical exam

- *Good luck!! Remember: if at first you don't succeed, so much for skydiving!* – Guide India
- *Hey, we're all winners! Let's keep it that way!* – Patrick (Canada)
- *Ha! Ha! Don't be nervous, cool! Best of luck to all.* – Sumit (India)
  - *Stay relaxed, good luck!* – Piter (driver)
  - *Always look on the (b)right (or left) side of life* – Johan (Sweden)
    - *We are all winners, but good luck anyway!* – Siim (Estonia)
      - *Chemistry is fun, just enjoy the test!* – Maaïke (Guide Hungary)
      - *I want to go home!!* – Singapore
      - *Just want to do my best* – Korea
  - *Will it be an exam tomorrow?!? I thought tomorrow we are supposed to go to Groningen's discos, that's all!* – Paulius (Lithuania)



In the control room

have a look at the control room. This really made the huge difference between the sea level and the polder water level visible for them! After this lengthy trip along typically Dutch places of interest, the tired but satisfied Olympians were brought back to Zuidbroek.

*On behalf of the students, we should again like to thank the "Hunze en Aa's" water board.*



Getting a breath of air near the Ems estuary

## A contribution of Sumit (India)

Once there was a lunatic in a mad house, laughing all day long. The doctor asked him why he laughed so much. "Because of my brother", he answered. Of course the doctor wanted to know how this came. "Me and my brother are twins and really look alike. So whenever my brother started a fight, I got slapped. If my brother committed a crime, I went to jail. When I got a girlfriend, he married her." "That's a pity", said the doctor, "so why are you laughing?". "I finally took revenge: now I am dead, but my brother got burried!"

## MTRO guides

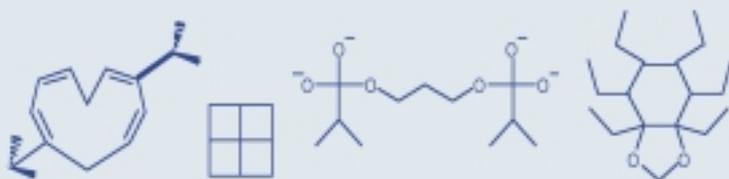


The group of guides can be divided into two categories. The first includes former Olympiad participants, who (at least to this year's participants) seem reasonably "normal." Most of the guides, however, study at the MTRO, a school that trains its students for middle-management positions in tourism and recreation. To them, the Olympiad week is a practical training assignment. Unfortunately, most of them do not know much about

chemistry and, strangely enough, they also seem less interested in it... But they feel the activities for the students are cool, great, and a lot of fun. The participants, they say, are very lovable and spontaneous. It is also very impressive to see people from all these different cultures interact. It strikes them that all participants feel absolutely free to make contacts and talk to one another. The world should follow their lead!

# What makes a chemist's life exciting?

- Watching the TLC solvent dry
- Mixing some  $\text{HNO}_3$  with glycerol
- Seeing things explode
- If a chemist gets energy, he (or she, red.) becomes excited
- Having a low activation energy
- Watching your reflux rxn for 1 hr...(monitoring temp). Isn't that fun?
- Being mad is very exciting
- A couple of exciting molecules (See figure):
  - Valentene,
  - Windowpane (actual molecule!)
  - Propyl people ether
  - Spider (these have 8 legs, red.)



## News

**TUESDAY 9 JULY:** The organization of the Chemistry Olympiad does its utmost to provide the participants with everything they need. To name just one example, Greetje Lap — the Olympiad secretary — organized a Maxi Cosi for the son of Icelandic student Helga Dögg Flosadóttir.

**TUESDAY 9 JULY:** The baggage of Cypriot student K. Koupparis — which was not delivered by the Schiphol Airport baggage carousel last Friday — has finally arrived. Mr Koupparis's belongings were delivered at the Zuidbroek hotel on Monday night.

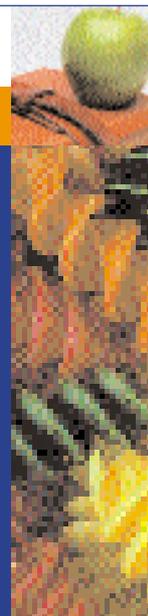
## What's on today's menu?

Wednesday 10 July 2002

### Dinner Zuidbroek

- Indian curry soup
- Veal escaloppes in tomato sauce
- Lasagna
- Vegetarian dish of the day
- Rice
- Boiled potatoes
- Gravy
- Today's vegetables
- Salad

Many thanks to the Zuidbroek chef!



6



34<sup>th</sup> International  
CHEMISTRY OLYMPIAD

Groningen | The Netherlands | 5 - 14 July 2002



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G2K designers, Groningen/Amsterdam



Thursday 11 July 2002

Issue no. 10

Journal for the 34th International Chemistry Olympiad | Groningen | The Netherlands | 5 - 14 July 2002

## *Theoretical Exam was difficult but doable*

For the third morning in a row, all students had to get up early. This time, everyone could find his or her place in the examination hall fairly quickly. At twenty past nine, the envelopes could finally be ripped open. Several contestants would also like to have the original English version of the exam paper besides the text that had been translated for them. This caused some panic offstage. At around 1 p.m., some young ladies from Iceland and Kuwait were the first to leave the hall for good, after several hours of excitement. They felt the exam had not been too difficult.



Stretching between questions

Unfortunately, they had been unable to answer several questions, but they still felt good about the exam. After that, the students gradually trickled out of the hall. They all agreed that the exam was doable, but also that it contained several difficult and unknown elements. Fortunately,

their guides were there to take care of them!

Now it is the turn of the scientific committee to mark the solutions to their exam questions. All the students have to do now is relax and look forward to the closing ceremony!



Prof. Meijerink overseeing the theoretical exam

Prof. Andries Meijerink (Red Ruby), member of the scientific committee, about the theoretical exam:

***“We have deliberately opted for short questions”***

“The members of the scientific committee had been given the following task: create an interesting, relevant test appropriate to the level of Dutch first and second-year university students of Chemistry. When constructing the theoretical exam, we have tried to cover as wide an

area as we could. Instead of five extensive questions, we have deliberately opted for ten relatively short questions ranging from biochemistry to physical chemistry. The exam will thus be interesting to all students. The

See page 3 >>

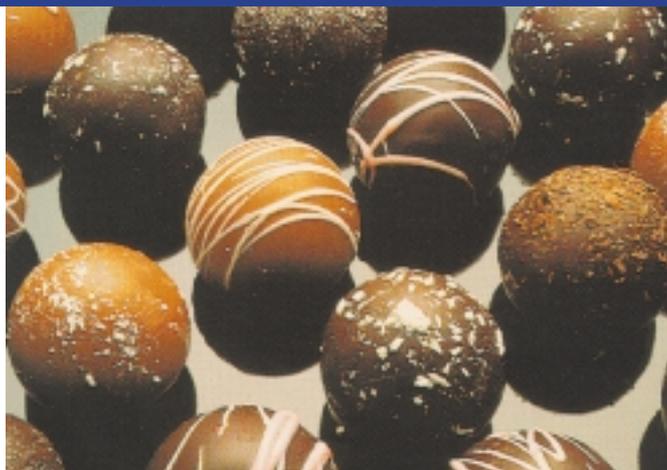
## No more white spots on chocolat

Who has never tasted the stale flavor of old chocolate, hard as rocks, lumpy, and covered in white spots? In the future, people may be spared this experience, since researchers of the NWO STW Technology Foundation working at the Laboratory for Crystallography of the University of Amsterdam — in cooperation with chocolate manufacturers — have come up with a method to prevent these white spots (caused by fat bloom) from being formed in chocolate. The method they have developed is also energy-efficient, space-saving, and applicable to large-scale manufacturing. A prototype machine is being developed. Chocolate threatens to become even more tasteful in the near future!

When you bite into a chocolate bar, what you basically do is crush cocoa butter crystals. The main ingredients of chocolate are cocoa butter, cocoa powder, and sugar. Cocoa butter crystallizes in six different crystalline phases (polymorphs). Each of these polymorphs has its own unique properties. Some are more stable than others, but the most stable form — required for chocolate of the highest quality — is the most difficult to obtain.

Fat bloom appears when unstable crystal cores are formed during the conventional chocolate manufacturing process. This happens when the hot chocolate mass cools to a temperature below 30 °C. These unstable crystal cores are only one thousandth of a millimeter in diameter. They will gradually turn into stable crystals. Sometimes this only occurs after several months. The transition is accompanied by the formation of the notorious white spots, the fat bloom. If the transition takes place after the production process (when the chocolate has been used in candy bars, confectionery, or chocolate letters), the quality of the final product will suffer. The fat bloom mainly develops when the chocolate is stored at too high temperatures.

Until now, chocolate manufacturers have used an energy-intensive method to convert the chocolate mass to its most stable form before using it in their final products. After all, the less unstable crystal cores in the chocolate mass, the less chance of fat bloom. To achieve this, they raise the temperature of the cooled chocolate again by several degrees, so that the unstable cores melt. This does not affect the stable cores that have already been formed. Then the chocolate mass is allowed to cool again. These steps are repeated several times. After this tempering



process, the chocolate mass consists almost entirely of stable cores; however, the process usually does not eliminate all unstable cores. To improve the production process and the quality of the chocolate, the researchers have first tried to get a better understanding of the irreversible phase transitions of cocoa butter at the molecular level. Cocoa butter is a complex mixture of about thirty different triacylglycerols (TAGs). TAGs are esters of glycerol with three long-chain fatty acids. Since each chain may differ in length and degree of saturation, there are many different TAGs. The hydrocarbon chains easily pack in different ways, which results in various polymorphs. The physical properties of TAG mixtures are largely determined by the properties of the individual TAGs in the mixture.

### Separated

The new insights into the behavior of TAGs at the molecular level have enabled the researchers to come up with a better, more energy-efficient production process. The new process involves adding a stream of liquid chocolate containing only stable cores to a liquid chocolate mass (in which no cores have been formed yet). Cooling then creates a product with such a high percentage of stable cores that it is impossible for fat bloom to occur. Part of the not quite cooled mass is separated and fed back to the mixing tank. Since this component is slightly cooler, even more stable cores are created. Sufficient new stable cores are formed to maintain a continuous chocolate production process. The Royal Dutch Academy of Sciences (KNAW) has awarded Dr Arjen van Langevelde the DOW Energy Prize for his thesis about this improved production process.



## Tomorrow's program

Friday 12 July 2002

### MENTORS / SCIENTIFIC OBSERVERS

From 06.00 Early breakfast at hotel  
07.00 Departure for Groningen: hotels and Martini Plaza  
08.00 Arbitration in Martini Plaza start first group  
19.00 Dinner at Martini Plaza  
20.00-24.00 Fourth Jury Meeting: Allocation of medals

### STUDENTS

06.00 Early breakfast at hotel  
07.30-22.00 Excursion to Amsterdam and surroundings

### GUESTS

08.00 Breakfast at hotel  
10.00 Departure for Groningen hotels  
13.00-17.00 Excursion Groningen and surroundings

## Trip to Amsterdam

While the IChO students were sweating over the theoretical exam, the mentors, observers, and guests went to Amsterdam. This meant an early breakfast, since it takes around 2.5 hours to get to Amsterdam from Friesland. The trip included an introduction to the Afsluitdijk, a boat tour through the Amsterdam canals, and visits to the Rijksmuseum and Science Museum Nemo. On the way back, dinner was served at a restaurant in Volendam, a picturesque fishing town on the shore of the IJsselmeer. There was plenty to see and photograph, so that the home front will also be able to get at least a glimpse of the



The Amsterdam skyline



At the Rijksmuseum



The Rijksmuseum

attractions: from stately mansions in the heart of Amsterdam to dike houses in Volendam, from Rembrandt and Van Gogh to Jan Steen. All in all, it was an interesting trip; one the students will certainly also enjoy when they follow in the footsteps of their mentors on Friday.



Touring the canals



Science Museum Nemo



The Amsterdam skyline

## 120,000 photocopies

For each contestant, 5 photocopies of the practical exam paper and 12 of the theoretical exam paper have been made. In total, this adds up to no less than 120,000 (one hundred and twenty thousand) photocopies. Undoubtedly, a fine example of the Greening of Chemistry.

### >> Prof. Andries Meijerink

questions also require the students to display their insights into the subject matter rather than their computation skills. The questions deal with four themes: Chemistry of Life, Chemistry of Industrial Relevance, Chemistry of Functional Molecules in Nature, and Chemistry Related to Light and Energy. The members of the scientific committee have not only formulated the questions for the exams, they will also mark the exam papers. Although between them they know many languages, they certainly do not speak the languages of all participants, which posed a major limitation to the format of the questions. The questions had to be formulated in such a way that only numbers and



Extremely hard at work...

diagrams need to be given as answers. A second examiner will also mark the questions, to corroborate the results of the first round. Finally, the mentors can comment on the final marking.

Incidentally, the reactions of the mentors to the exam questions were positive. They felt the exam was interesting and topical. The English was also considered to be good."

# Are Frisians smarter than the other Dutch?

Jan Apotheker, chair of the 34th IChO, will make a statement to that effect in a show broadcast tonight by Omrop Fryslân, the Frisian radio and TV station. "Actually, the remark sort of slipped out before I knew it. But it is a fact that the number of Frisian participants is relatively high. The main reason for this is that Friesland has some

highly dedicated Chemistry teachers who stimulate their students to participate. Particularly the Feitsma family — with 4 participants in various IChO's — has been highly successful. The youngest child in the family will participate next year, if he makes it through the Dutch qualifying round. Another Frisian participant, Arjen Cossen, is the son of two Chemistry teachers, so what can you expect?"

## Finnish competitor

**WEDNESDAY 10 JULY:** The students will really do anything to take the exams at all costs. A good example is Finnish competitor P. Valkama. He is presently afflicted by an allergic reaction to the Dutch weather. Add to that a sleepless night due to an asthma attack, and you will agree that these are not the best of circumstances for taking a theoretical test. Nevertheless, he is now doing exactly that. Hats off to him!

## English version

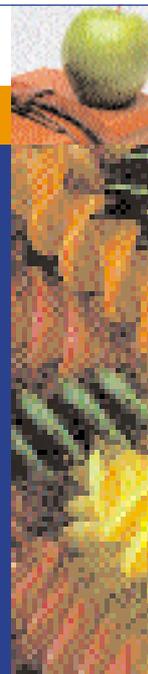
**WEDNESDAY 10 JULY:** Although most aspects of this Chemistry Olympiad are met with great enthusiasm by all involved, it appears difficult to translate the exam questions satisfactorily. Many students therefore asked for a copy of the original English version.

## What's on today's menu?

Thursday 11 July 2002

### Dinner Buffet at It Wiid

- Greek tomato and bell pepper soup
- Chicken paté with berry sauce
- Salmon and dill salad
- Various types of breads with butter
- Osso bucco (veal stew)
- Ham off the bone with rosemary sauce
- Moussaka (Greek potato dish)
- Deep-fried Duchesse potatoes
- Grilled rib-eye steak with garlic
- Octopus rings
- Spare ribs
- Vegetarian dish of the day
- Italian cassata



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Friday 12 July 2002

Issue no. 11

Journal for the 34th International Chemistry Olympiad | Groningen | The Netherlands | 5 - 14 July 2002

## *The Olympics in the Olympiad*

The atmosphere at year's Olympiad is clearly competitive. The participants are challenged to represent their countries on more occasions than at the official exams only. After the game of living Stratego at Bourtange, the students could prove themselves yesterday at the Mega Olympic Games. The Break Out team had organized a sports afternoon near Harkstede, with all kind of typical Dutch games. Although, Dutch ... Sumo wrestling surely is a Japanese sport, isn't it? Now and then the activities were interrupted by an — also typically Dutch — shower, but this did not deter the participants.

"Those Dutch games are crazy!" said one rather dumbfounded student. At the start of each new game, the students remain on the fence but when the biggest daredevils made an effort after the game was explained to them, the others soon



See page 3 >>

A sack race is not an easy thing when there's two to a sack...

## *Paul Crutzen: guardian of the biosphere's Achilles heel*

The last Dutchman to receive the Nobel Prize for Chemistry was Paul Crutzen. In 1995, he shared the prize with Americans Mario Molina and Sherwood Rowland "for their work in atmospheric chemistry, particularly concerning the formation and decomposition of ozone," as the Nobel Prize Committee put it.

Solar rays contain much hard ultraviolet (UV-B) rays that are harmful to life on earth. The first lifeforms — anaerobic microorganisms — therefore emerged three billion years ago in the ocean, at a safe depth of around ten meters. One of the waste products of this life was oxygen. Once in the atmosphere, part of this oxygen was converted to ozone (O<sub>3</sub>) under the influence of solar rays. This gas absorbed the harmful UV-B radiation and thus created an essential condition for the future development of life on earth.



where M is a random air molecule (N<sub>2</sub> or O<sub>2</sub>).

Only a small amount of ozone in the atmosphere protects us against harmful radiation these days. If all the ozone in the atmosphere were compressed to a pressure corresponding to that at the earth's surface, this layer would be only 3 mm thick.

### **Much lower**

In 1930, British physicist Sidney Chapman was the first to describe how sunlight causes the transformation of one form of oxygen to another. He also explained why the highest ozone concentration occurs in the layer between 15 and 50 km, the ozone layer.



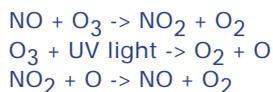
Prof. Paul Crutzen

See next page >>

三十四目の化学オリンピックはそろそろ終わってしまいましたが、  
経験が面白かったのを祈っています…

## >> Crutzen

However, his description did not completely correspond with subsequent measurements, which indicated a much lower concentration of ozone than Chapman had predicted. In 1970, Dutchman Paul Crutzen proposed an explanation for these lower values. He showed that the nitrogen oxides NO and NO<sub>2</sub> react catalytically with ozone, thus accelerating the rate of reduction of the ozone content.



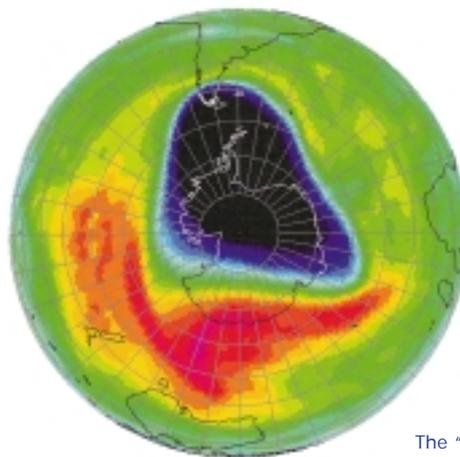
Net result:  $2\text{O}_3 \rightarrow 3\text{O}_2$

The role of the nitrogen oxides also connected the biological processes at the earth's surface with atmospheric processes, since these nitrogen oxides originate from microbiological transformations at ground level.

In 1974, this relationship led Americans Mario Molina and Sherwood Rowland to publish their idea that chlorine

originating from chlorofluoro-carbon (CFC) gases could also break down ozone, in the same way as NO. The difference is that more than 90% of the NO is natural, while atmospheric chlorine is almost exclusively of man-made origin. These CFC gases were used in spray bottles, as a cooling medium in refrigerators, in plastic foams, and elsewhere.

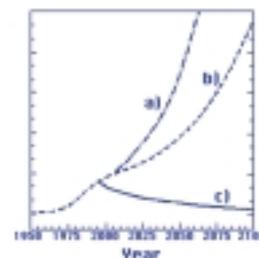
In the years that followed, the question whether mankind would be capable of depleting the highly important ozone layer was hotly debated. The real shock came in 1985, when Joseph Farman and two colleagues noted a drastic



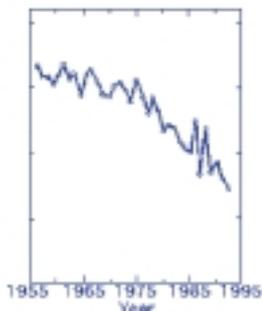
The "ozone hole" in October 2000

depletion of the ozone layer over the Antarctic, the "ozone hole." Crutzen was one of the main contributors to the explanation of this phenomenon; later, he also helped to explain the role of ozone as a greenhouse gas at lower altitudes in the atmosphere.

Partly as a result of agreements (the Montreal Protocol) signed in 1987 and 1996 under the auspices of the United Nations, the most dangerous gases will be totally banned. It is expected that the depletion of the ozone layer will come to a halt and that this vulnerable solar shield may even be restored. However, this may take as long as a hundred years.



Change in the chlorine content in the stratosphere up to the present and three different future scenarios: a) Without restrictions on release, b) Limitations according to the original Montreal Protocol of 1987 c) The release limitations now internationally agreed. (Chlorine content is a measure of the magnitude of ozone depletion.) Source: The NOBEL e-MUSEUM.



Thickness of the ozone layer (mean monthly value for October) over Halley Bay, Antarctica. Note the drastic depletion since the end of the 1970s. Source: The NOBEL e-MUSEUM.



## Tomorrow's program

Saturday 13 July 2002

### MENTORS / SCIENTIFIC OBSERVERS

08:00 Breakfast at hotel  
09.00-13.00 Free time for shopping and lunch  
16:00 Closing Ceremony at Martini Plaza Theater  
18:00 Aperitif at Martini Plaza  
19:00 Closing Dinner at Martini Plaza  
21.00-24.00 Party

### STUDENTS

10:30 Brunch at hotel  
12:00 Departure for Groningen: Free time for shopping  
14:45 Departure for Martini Plaza  
15:00 Rehearsal for the Closing Ceremony  
16:00 Closing Ceremony  
18:00 Aperitif  
19:00 Closing Dinner  
21.00-24.00 Party

### GUESTS

08:00 Breakfast at hotel  
09.00-13.00 Free time for shopping and lunch  
16:00 Closing Ceremony at Martini Plaza  
18:00 Aperitif at Martini Plaza  
19:00 Closing Dinner at Martini Plaza  
21.00-24.00 Party

## >> The Olympics in the Olympiad

followed. "We're gonna win!" was a muchheard cry, for example during the blind volleyball game. Initially, many wondered how you could possibly play volleyball blindfolded. The game is based on a similar game in which the net has been replaced by a piece of fabric, so that the players do not see what the opposing team is doing when they have the ball. These games therefore require uncanny reflexes. Unfortunately, not everyone could win: "Though we lose all the time, it's great fun," said Arjun from India. The eight best teams had to compete with each other in a tug of war. Finally, the combined team of Ireland, Belgium and



"Grab my hand!"  
"Yeah, I got the rope!" Through good team effort, even the highest slippery slop can be overcome.



"We very much liked the sliding with a round tube off a ramp." The team of France and Rumania set a record of 37 slides in 7 minutes, performed by 7 people.

Switzerland finished first with 41 points and was awarded a tasty cream cake. All this effort made the students very hungry. Fortunately, the barbecues were already hot enough to receive the sausages, hamburgers, and skewers to be consumed by the students.

*Many thanks to the Break Out team!*



Hitting the target is difficult when you have to use such a big bow. Still, most students scored points in this game too.



"Please, can you give me my helmet, I really can't move in this suit?!"

## *Six reasons to be here*

- To solve stupid problems!!
- Good question... – Toby (UK)
- Nice question to think upon. For fun, what else (Ha! Ha! Ha!) – Sumit (India)
- If you won a free trip to Holland, wouldn't you go? – Martin (UK)
- These days are brilliant holidays, but during the tests I thought I was brought into wrong plane (or train), like, perhaps, others. But we all are in the "same ship." – Paulius (Lithuania)
- For the pretty women – a Cypriot student

## Skûtsjesilen



The Frisian Skûtsje is a sailing vessel with an extremely shallow draught and no keel. This is why the vessel lies more on than in the water and can even be used when the water is not very deep. In the old days, these ships were used to transport a variety of goods. Today, they are being raced. Because they have no keel, they would soon go “skating” across the water when the main sail picks up a bit of wind. This problem has been solved by mounting two leeboards on each side of the vessel that can be lowered and raised into the water. Like a genuine keel, these leeboards ensure that the ship cannot move sideways, but they do not increase the draught as they can be raised.



### Stiff wind

The mentors, observers, and guests have sailed in comfortable weather on several Skûtsjes for

two hours. The stiff wind gave the ships more than decent speed; even the professional sailors among the passengers agreed that it had been excellent sailing weather!

The mentors have had sufficient fresh air to get them ready for their final job: joining battle to ensure optimum scores for the students in their teams.

## Private study for Saturday

To make an absolute success of the final party on Saturday, it would be nice if everyone could study the — Dutch — song printed below. The pronunciation is, of course, somewhat difficult to explain on

paper, but you will soon get the hang of it at the party... Some private study is certainly worthwhile; after all, this is a tune written by the by now legendary Dutch composer Herman Boek:

*Trap nooit zo maar tegen een  
eend, want een eend is ook iemand  
zijn moeder*

*Hij zwemt in een sloot of in een  
plas,  
of ergens anders waar het nat was*

*Nu denkt u misschien dit is het  
eind,  
dat is het ook.*

## Experiencing the nightlife of Groningen

Wednesday night the Olympians have prowled the city center of Groningen in droves. The flipchart near the dining room called on all students to come in lab coat and goggles. Some indeed rose to occasion and did so...

Although going out was a new experience for some, most participants enjoyed themselves tremendously. They were taken to the bowling alley, where the scores of the various countries were recorded carefully. In the end, the Byelorussian team were the winners, with 137 points in 10 throws. The contestants could let their hair down in various pubs and forget all about the theoretical exam. Drinks in front of them, they could either choose to go dancing or simply lounge away the evening. The festivities came to a terrific close in discotheque The Palace.



Live music in Irish pub Sally's



The real bowling move



Conga at "De Drie Gezusters" café



Everyone goes crazy on the Palace dance floor

## In the limelight: Dutch mentors

For the Dutch team, the 34th IChO is a special experience in the sense that they do not have to go abroad to participate. This also means that the trips they are going on take place in their own country, which — if all is well — they already know like the back of their hand. Even more extreme: mentor Johan Broens's cottage at 't Wiid is only 6 km from his own home, which means he knows the neighborhood intimately. We have asked him and Emiel de Kleijn for a reaction...

They both agree that it does not make a big difference whether you go abroad or not for the IChO. They are still isolated, now in a holiday park, and they are still surrounded by many foreigners. In the evening they join the Belgian delegation in the cottage to muse over the events of the day. So, it is still a unique experience. A cottage also works much better than a hotel room when it comes to making contacts with the other mentors. And as far as the trips go, they both had never been on a skûtsje before, so that was a very

impressive experience. The route, incidentally, was the same one as Johan often sails in his own cabin cruiser.

Not only the cottages and the trips receive their highest praise; the food has been excellent and always served in very special restaurants situated in interesting places. Great care must have gone into their selection, they believe. Finally, they are extremely grateful to their guide Shing Yu Ng for all her efforts. As far as they are concerned, she is the brightest star at the organization's firmament.

## Did you know that...

- The guide of China has brought six swimming trunks.
- The prediction made by the guide of Byelorussia (Catalyzer 7) has already been surpassed because the team won four gold medals with bowling.
- The Australians can't be trusted, but they do know interesting Did-you-know-thats. For example, the following warning: "Watch out for imitation Polish people, you can tell by the way they can't hold their beer."
- Icelandic scientists have made groundbreaking progress in organic insulators, thereby enabling Erlandur to survive the bitter 4 a.m. cold with just a T-shirt and a vodka.
- Some of us have been treated to the pleasure of non-stop Azerbaijani music on bus no. 6. But now you can all see a dancing showcase extraordinary. Be there on the last evening!

## Finnish student

THURSDAY 11 JULY: Yesterday we reported that Finnish student P. Valkama had suffered an allergic reaction in combination with an asthma attack. Unfortunately, his condition has not improved and he was forced to return to Finland this morning.

## A real dessert

THURSDAY 11 JULY: Many students had already asked for it and yesterday they finally got what they wanted: they were treated to a real dessert. Although the idea was to put yoghurt and custard on the table, "kwark" (a kind of cream cheese) was what they got. A delicious alternative.

## From the flipchart

- I forgot the recipe for acetone peroxide. Does anyone know it? 1 part  $(\text{CH}_3)_2\text{CO}$ ; 2 parts  $\text{H}_2\text{O}_2$ ; acid (for pH, HCl or  $\text{H}_2\text{SO}_4$  or....) => white stuff

Balance the following equations:

- $a \text{Pb}(\text{N}_3)_2 + b \text{Cr}(\text{MnO}_4)_2 \rightarrow c \text{Pb}_3\text{O}_4 + d \text{Cr}_2\text{O}_3 + e \text{MnO}_2 + f \text{NO}$  - Dimitar (Bulgaria)
- $a \{\text{Cr}[\text{CO}(\text{NH}_2)_2]_6\}_4 \cdot [\text{Cr}(\text{CN})_6]_3 + b \text{HNO}_3 + c \text{KMnO}_4 \rightarrow d \text{K}_2\text{Cr}_2\text{O}_7 + e \text{CO}_2 + f \text{N}_2 + g \text{H}_2\text{O} + h \text{Mn}(\text{NO}_3)_2 + i \text{KNO}_3$   
The Catalyzer reporters have already received a solution from Croatia. Who's next?
- $\text{WO}_4^- + \text{Cl}_2 + \text{C} \rightarrow \text{WC} + \text{COCl}_2$



Mallinckrodt Baker



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Saturday 13 July 2002

Issue no. 12

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## Trip to Amsterdam and the surrounding are

As everyone will undoubtedly have noticed, the buses were chock-a-block full this morning. Unfortunately, the Catalyzer editors were once again condemned to get on the no. 6 bus. This is "naturally" also the most fun bus, but a little variation would have been nice. Also, a good story about the trip to Amsterdam has already appeared in Catalyzer 10. All the more reason to do things differently this time... Several students from — you guessed it — bus no. 6 were friendly enough to answer some questions about Amsterdam. It appeared that the city is best known to most of them for its leaning houses and rooftops. When Denis and Alexey from Byelorussia talk about Amsterdam,

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Getting up very early on Friday morning to catch the bus to Amsterdam. Not surprising, then, that many students used the first hour or so to "work off" their shortage of sleep.

## Dear participants,

By the time you read this, the closing ceremony will have finished and the 34th International Chemistry Olympiad will be over. A group of more than 150 people has worked hard to make this week a success. I am grateful that I have been privileged to be part of this team. The cooperation has been great and the result was a fantastic week. Everybody did just that little bit extra whenever it was necessary. The same goes for our guests, students, and mentors. You let us know you were enjoying yourselves.

I hope you will look back on the past week with fond memories. Greece will now take over. I wish them lots of success with their organization and I hope to meet everyone again in Athens.

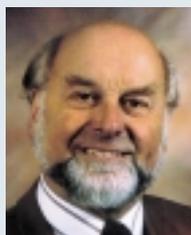


**Jan Apotheker**  
organization chair

## Dear students, mentors and guests,

Organising an International Chemistry Olympiad means collecting many skilled and interested persons and many sponsors. They combine 23 years of experience with fresh ideas and today's chemistry. You'll need any kind of help you can get, from both professionals and from amateurs.

In this wonderful week, two years' work come to a melting pot, where 57 kinds of reactants mature to form a new world order in chemistry knowledge of secondary school students. Unique in the world, unique in the world of chemistry education! All the young men and women at the Chemistry Olympiad are indeed the best and the brightest of the nations' future chemists and other scientists. This and the promotion of chemistry as an exciting and dynamic science for together our intentions to organise the 34th International Chemistry Olympiad. Thanks to all who worked hard, the organisers, the scientists, the sponsors and everybody who helped to create this wonderful event.



Thanks to you participants, students, mentors and guests. You are unforgettable. I thank you on behalf of the whole organising team for your support. Without you no Olympiad! We will miss you.

*Have a safe trip home!*

**Wout Davids**  
President of the 34th IChO

>> Amsterdam

on the other hand, they mention its magnificent airport, lots of bicycles (and bicycle thieves) and an abundance of historic buildings. Unfortunately, our survey is slightly biased because the Belgians had already visited Amsterdam several times. The students learned a lot at Science Museum Nemo. Even 50 minutes was too short for Sam (Australia) and Christophe (Belgium) to discover new science. Ollie (Australia again) found that he's not really 5 years old at heart; he's probably more like 3! One of the greatest achievements came from Araz (Azerbaijan), who managed to balance six nails on one!! Marie-Louise (Belgium) and the Byelorussian students in



Fortunately, the guides were still awake enough to create some atmosphere.

this bus came to the conclusion that the bicycles were the most "typically Dutch" characteristic of Amsterdam. To Christophe, the "Amsterdammekes," the red posts along the street preventing

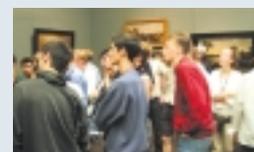
unauthorized parking, were the most striking feature. Some are apparently still somewhat alarmed by the trip to the water board on Tuesday. They find it very typical of the Dutch that they live below sea level. Araz paid most attention to the souvenir shops, since his most vivid memory of Amsterdam is the wooden shoes...



A fair amount of cooperation is necessary to guide a drop of mercury successfully through a maze.



Our hunger and thirst were excellently quenched at a traditional Dutch eatery.



Besides the Nightwatch, the Rijksmuseum appeared to have many other beautiful paintings in store for us!



## Tomorrow's program

Sunday 14 July 2002

MENTORS / SCIENTIFIC OBSERVERS

STUDENTS

GUESTS

Departure

Departure

Departure

# Results of the 34th International Chemistry Olympiad

| FAMILYNAME          | INITIALS | SEX | COUNTRY        | MEDALS | RANK |
|---------------------|----------|-----|----------------|--------|------|
| SALIERNO            | G.       | M   | ARGENTINA      | B      | 98   |
| NUÑEZ               | P.       | M   | ARGENTINA      | B      | 105  |
| CORDONE             | M.       | M   | ARGENTINA      | B      | 130  |
| ABERBUJ             | P.       | M   | ARGENTINA      |        | 170  |
| WONG                | A.       | M   | AUSTRALIA      | G      | 22   |
| SALMAN              | S.       | M   | AUSTRALIA      | S      | 43   |
| TENG                | G.       | M   | AUSTRALIA      | B      | 92   |
| THORN-SESHOLD       | O.       | M   | AUSTRALIA      | B      | 111  |
| KOLLER              | D.       | M   | AUSTRIA        | G      | 9    |
| STECHER             | T.       | M   | AUSTRIA        | G      | 26   |
| THALHAMMER          | A.       | M   | AUSTRIA        | S      | 31   |
| LUDL                | P.       | M   | AUSTRIA        | S      | 76   |
| CAVADOV             | A.       | M   | AZERBAIJAN     | B      | 132  |
| HEYBATOV            | E.       | M   | AZERBAIJAN     |        | 206  |
| DAVUDOV             | D.       | M   | AZERBAIJAN     |        | 215  |
| MUSAYEV             | O.       | M   | AZERBAIJAN     |        | 216  |
| PIATKEVICH          | K.       | M   | BELARUS        | S      | 53   |
| MENSHYKAU           | D.       | M   | BELARUS        | B      | 83   |
| PUTAU               | A.       | M   | BELARUS        | B      | 119  |
| ZHDANKO             | A.       | M   | BELARUS        | B      | 127  |
| VERCAUTEREN         | D.       | M   | BELGIUM        | H      | 156  |
| JOTTRAND            | L.       | M   | BELGIUM        |        | 166  |
| TASSIN              | C.       | M   | BELGIUM        | H      | 174  |
| COLLIGNON           | M.-L.    | F   | BELGIUM        |        | 187  |
| SAMMUEL COSTA DE MO | Y.       | M   | BRAZIL         | B      | 113  |
| TAJRA FONTELES      | R.       | M   | BRAZIL         | B      | 118  |
| MAIA DE OLIVEIRA    | A.       | M   | BRAZIL         | H      | 190  |
| PEREIRA SARAIVA     | J.       | M   | BRAZIL         | H      | 199  |
| PASHOV              | D.       | M   | BULGARIA       | B      | 102  |
| SHUSHKOV            | F.       | M   | BULGARIA       | B      | 116  |
| IVANOV              | D.       | M   | BULGARIA       | H      | 148  |
| BELEZHANSKA         | Y.       | F   | BULGARIA       |        | 173  |
| KIM                 | J.H.     | M   | CANADA         | S      | 35   |
| HONG                | L.       | M   | CANADA         | S      | 48   |
| TSENG               | W.L.     | M   | CANADA         | S      | 50   |
| YEUNG               | S.H.     | M   | CANADA         | B      | 89   |
| ZHU                 | Y.       | M   | CHINA          | G      | 1    |
| LU                  | H.       | M   | CHINA          | G      | 2    |
| LIU                 | W.       | M   | CHINA          | G      | 5    |
| WANG                | F.       | M   | CHINA          | G      | 6    |
| KASSAL              | I.       | M   | CROATIA        | G      | 23   |
| KOLUNDEIE           | F.       | M   | CROATIA        | B      | 114  |
| FRANJIE             | N.       | M   | CROATIA        | H      | 153  |
| CORIE               | I.       | M   | CROATIA        |        | 196  |
| BRAVO RODRIGUEZ     | K.       | M   | CUBA           |        | 165  |
| PEREZ BARZAGA       | V.       | M   | CUBA           | H      | 184  |
| GONZALEZ VALDES     | I.B.     | F   | CUBA           |        | 188  |
| HERNANDEZ GONZALEZ  | J.E.     | M   | CUBA           |        | 212  |
| KOUPPARIS           | K.       | M   | CYPRUS         |        | 181  |
| MATSIKARIS          | K.       | M   | CYPRUS         |        | 192  |
| VOLOS               | S.       | M   | CYPRUS         |        | 197  |
| NICOLAIDIS          | C.       | M   | CYPRUS         |        | 202  |
| PLUHAROVA           | E.       | F   | CZECH REPUBLIC | B      | 87   |
| CHUDOBA             | R.       | M   | CZECH REPUBLIC | B      | 100  |
| DRAHOS              | B.       | M   | CZECH REPUBLIC | B      | 103  |
| MIKULKA             | T.       | M   | CZECH REPUBLIC |        | 154  |
| ERSBAK BANG NIELSEN | A.       | F   | DENMARK        | S      | 55   |
| KRISTIANSEN         | M.       | M   | DENMARK        | B      | 125  |
| WALDORFF            | D.       | F   | DENMARK        |        | 169  |
| LAURIDSEN           | T.       | M   | DENMARK        | H      | 183  |
| ABD-ELMALCK         | M.       | F   | EGYPT          |        | 218  |
| YEHYA               | A.       | M   | EGYPT          |        | 221  |
| ZAHARAN             | N.       | F   | EGYPT          |        | 224  |
| SOUBIH              | A.       | M   | EGYPT          |        | 225  |
| IVANISTSEV          | V.       | M   | ESTONIA        | S      | 33   |
| STARKOV             | P.       | M   | ESTONIA        | S      | 49   |
| TAMJAR              | E.       | F   | ESTONIA        | H      | 162  |
| KARUS               | S.       | M   | ESTONIA        | H      | 201  |
| RASALA              | T.       | M   | FINLAND        | S      | 70   |
| VALKAMA             | P.       | M   | FINLAND        | B      | 78   |
| JARVINGENI          | T.       | M   | FINLAND        | B      | 96   |
| KANGASNIEMI         | T.       | M   | FINLAND        | H      | 144  |

|                     |      |   |            |   |     |
|---------------------|------|---|------------|---|-----|
| BOCQUET             | A.   | M | FRANCE     | S | 56  |
| MONSERAND           | B.   | M | FRANCE     | S | 69  |
| CARTIGNY            | D.   | M | FRANCE     | B | 133 |
| SCHILTZ             | A.   | M | FRANCE     |   | 145 |
| RODENBERG           | A.   | M | GERMANY    | G | 27  |
| KLUEPFEL            | S.   | M | GERMANY    | S | 37  |
| PLATE               | L.   | M | GERMANY    | S | 60  |
| LEDOCHO-WITSCH      | P.   | M | GERMANY    | S | 73  |
| MARINOPOULOS        | K.   | M | GREECE     | H | 172 |
| MOUSTAKAS           | N.   | M | GREECE     |   | 175 |
| KORDONIS            | I.   | M | GREECE     |   | 178 |
| SZALAY              | Z.   | F | HUNGARY    | G | 14  |
| BEIN                | M.   | M | HUNGARY    | S | 32  |
| PARAZS              | D.   | M | HUNGARY    | B | 86  |
| BALOGH              | J.   | M | HUNGARY    | B | 108 |
| JONSSON             | E.   | M | ICELAND    | H | 193 |
| SIGHVATSSON         | H.   | M | ICELAND    | H | 198 |
| OMARSDOTTIR         | L.O. | F | ICELAND    |   | 204 |
| FLOSADOTTIR         | H.D. | F | ICELAND    |   | 211 |
| KUMAR(1)            | S.   | M | INDIA      | G | 3   |
| DEWANI              | S.   | M | INDIA      | G | 18  |
| KRISHNAN            | A.   | M | INDIA      | B | 97  |
| SHIVARAMAN          | S.   | M | INDIA      | B | 106 |
| ABDILLAH            | P.A. | M | INDONESIA  | B | 91  |
| TAUFIQUEUROHMAN     | M.F. | M | INDONESIA  |   | 167 |
| JIMRON              | B.   | M | INDONESIA  |   | 186 |
| SALIM               | T.   | M | INDONESIA  |   | 195 |
| TORABI              | N.   | F | IRAN       | G | 19  |
| SHAHI               | M.   | M | IRAN       | S | 41  |
| SHIRDEL             | M.   | M | IRAN       | S | 68  |
| AQAIARY             | J.   | M | IRAN       | B | 82  |
| MALOFEEV            | V.   | M | IRELAND    | B | 129 |
| TONER               | D.   | F | IRELAND    | B | 136 |
| MC GEE              | P.   | F | IRELAND    |   | 205 |
| MAC NAMARA          | M.   | M | IRELAND    |   | 209 |
| ROSI                | G.   | M | ITALY      | B | 94  |
| CERICOLA            | D.   | M | ITALY      | B | 95  |
| DI ANTONIO          | M.   | M | ITALY      | H | 146 |
| CREATI              | F.   | M | ITALY      |   | 194 |
| ISKAKOV             | A.   | M | KAZAKHSTAN | S | 58  |
| NURTAZIN            | A.   | M | KAZAKHSTAN | S | 61  |
| NURGABDESHOV        | A.   | M | KAZAKHSTAN | H | 158 |
| TULEBEKOV           | Y.   | M | KAZAKHSTAN | H | 159 |
| KIM                 | M.H. | M | KOREA      | G | 10  |
| LEE                 | J.H. | M | KOREA      | G | 12  |
| KIM                 | Y.J. | M | KOREA      | S | 52  |
| KIM                 | I.S. | M | KOREA      | S | 72  |
| ALJASSAR            | F.   | M | KUWAIT     |   | 217 |
| BARON               | F.   | F | KUWAIT     |   | 220 |
| ALHASAN             | L.   | F | KUWAIT     |   | 222 |
| ABDULJABAR / ALFELA | R.   | F | KUWAIT     |   | 223 |
| AMATOV              | T.   | M | KYRGYZSTAN | H | 152 |
| SABYROV             | K.   | M | KYRGYZSTAN | H | 185 |
| JUMABAEV            | S.   | M | KYRGYZSTAN | H | 207 |
| ESTEBESOV           | E.   | M | KYRGYZSTAN |   | 219 |
| SIZOVS              | A.   | M | LATVIA     | S | 64  |
| VALTERS             | D.   | M | LATVIA     | B | 101 |
| KIZJAKINA           | K.   | M | LATVIA     | B | 140 |
| PROKOFJEUS          | A.   | M | LATVIA     |   | 157 |
| TAMOSIUNAS          | P.   | M | LITHUANIA  | S | 66  |
| BACELIS             | J.   | M | LITHUANIA  | S | 67  |
| KUBILIUS            | J.   | M | LITHUANIA  | B | 134 |
| BAGDZIUNAS          | G.   | M | LITHUANIA  | B | 143 |
| DIAZ TINOCO         | M.A. | M | MEXICO     | B | 109 |
| YUEN ZHOU           | J.   | M | MEXICO     |   | 150 |
| MARQUEZ SALCEDO     | A.   | F | MEXICO     |   | 164 |
| MENDOZA             | J.   | M | MEXICO     | H | 191 |
| ROSENTHAL           | A.   | M | NEDERLAND  | B | 93  |
| MOONS               | H.   | M | NEDERLAND  | B | 122 |
| GROOTE              | R.   | M | NEDERLAND  | B | 124 |
| CNOSSEN             | A.   | M | NEDERLAND  | B | 137 |

|                     |      |   |                    |   |     |
|---------------------|------|---|--------------------|---|-----|
| PENG                | K.   | M | NEW ZEALAND        | B | 99  |
| LAU                 | P.   | M | NEW ZEALAND        | B | 135 |
| YEARSLEY            | A.   | M | NEW ZEALAND        | B | 139 |
| MASON               | G.   | F | NEW ZEALAND        | H | 161 |
| VESTLI              | K.   | M | NORWAY             | G | 24  |
| LUDVIGSEN           | M.   | F | NORWAY             | H | 149 |
| LINDSTROM           | C.   | F | NORWAY             | S | 155 |
| FORLAND             | M.   | F | NORWAY             | H | 210 |
| KALEK               | M.   | M | POLAND             | G | 4   |
| BIL                 | J.   | M | POLAND             | G | 16  |
| KARBOWNIK           | M.   | M | POLAND             | S | 63  |
| SKOMOROWSKI         | W.   | M | POLAND             | B | 117 |
| SIMA                | S.   | M | ROMANIA            | S | 44  |
| GLAVAN              | A.   | F | ROMANIA            | B | 112 |
| NEDELICU            | D.   | M | ROMANIA            | B | 121 |
| RACOVITA            | R.C. | M | ROMANIA            |   | 179 |
| SEDOV(3)            | I.   | M | RUSSIAN FEDERATION | G | 20  |
| SOLOVYEV            | A.   | M | RUSSIAN FEDERATION | S | 30  |
| GLEBOV              | I.   | M | RUSSIAN FEDERATION | B | 110 |
| LARIONOV            | E.   | M | RUSSIAN FEDERATION | S | 74  |
| LUI                 | P.L. | M | SINGAPORE          | S | 42  |
| TAN                 | C.G. | M | SINGAPORE          | S | 57  |
| TAN                 | Y.X. | F | SINGAPORE          | B | 79  |
| WANG                | R.R. | F | SINGAPORE          | B | 120 |
| SZABO               | E.   | M | SLOVAKIA           | S | 71  |
| REPKO               | A.   | M | SLOVAKIA           | B | 80  |
| KARLUBIKOVA         | O.   | F | SLOVAKIA           | B | 107 |
| HROBARIK            | T.   | M | SLOVAKIA           | B | 123 |
| GRADISEK            | T.   | M | SLOVENIA           | B | 115 |
| SIVIC               | K.   | M | SLOVENIA           | B | 128 |
| RADE                | K.   | F | SLOVENIA           | B | 138 |
| RODMAN              | J.   | F | SLOVENIA           |   | 189 |
| MARTI CENTELLES     | V.   | M | SPAIN              | S | 46  |
| IRANZO SANZ         | J.   | M | SPAIN              | S | 62  |
| CEBALLOS CARRAS-COS | P.   | F | SPAIN              | B | 85  |
| ENCISO CARRASCO     | M.   | F | SPAIN              |   | 147 |
| MERTALA             | A.   | F | SWEDEN             | B | 142 |
| GENBERG             | J.   | M | SWEDEN             | H | 151 |
| HOLMQVIST           | J.   | M | SWEDEN             |   | 163 |
| COORAY              | C.   | M | SWEDEN             | H | 200 |
| KOTYRBA             | M.   | M | SWITZERLAND        |   | 160 |
| SCHNEEBELI          | S.   | M | SWITZERLAND        |   | 171 |
| LUDWIG              | P.   | M | SWITZERLAND        |   | 177 |
| PAZHEPURACKEL       | V.   | F | SWITZERLAND        | H | 213 |

g = gold  
s = silver  
b = bronze  
h = honorable mention

(1) = best practice  
(2) = best female student  
(3) = best theory

|                |       |   |                |   |     |
|----------------|-------|---|----------------|---|-----|
| LIN(2)         | C.Y   | F | TAIWAN         | G | 13  |
| LIN            | C.-J. | M | TAIWAN         | G | 7   |
| WANG           | Y.-C. | M | TAIWAN         | S | 34  |
| TSAI           | C.-Y  | M | TAIWAN         | S | 45  |
| UTTAMAPINANT   | C.    | M | THAILAND       | G | 11  |
| JIRAPINYO      | P.    | F | THAILAND       | G | 15  |
| NAKORNCHAI     | C.    | F | THAILAND       | G | 17  |
| NETIROJJANAKUL | C.    | F | THAILAND       | S | 39  |
| WEGNER         | S.    | F | TURKEY         | S | 29  |
| BARIN          | G.    | M | TURKEY         | S | 65  |
| OZKALAY        | B.    | F | TURKEY         | B | 77  |
| KOTOKDISLI     | M.    | M | TURKEY         | B | 81  |
| HAYFIYEV       | S.    | M | TURKMENISTAN   | B | 131 |
| BEGLYEV        | A.    | M | TURKMENISTAN   | B | 141 |
| ROZIYEV        | P.    | M | TURKMENISTAN   |   | 168 |
| HODJONAZAROV   | N.    | M | TURKMENISTAN   |   | 208 |
| PANOV          | D.    | M | UKRAINE        | G | 8   |
| VECHORKIN      | O.    | M | UKRAINE        | S | 28  |
| RADCHENKO      | D.    | M | UKRAINE        | S | 47  |
| GOROKHOV       | A.    | M | UKRAINE        | S | 54  |
| KORYCHZAN      | J.    | M | UNITED KINGDOM | S | 38  |
| TRIN           | N.    | M | UNITED KINGDOM | S | 59  |
| BARROWS        | T.    | M | UNITED KINGDOM | B | 84  |
| BOLTON         | E.    | M | UNITED KINGDOM | B | 104 |
| DAVENPORT      | T.    | M | UNITED STATES  | B | 90  |
| SHI            | H.    | F | UNITED STATES  | G | 21  |
| CISSELL        | D.    | M | UNITED STATES  | G | 25  |
| WHITTAKER      | C.    | M | UNITED STATES  | S | 36  |
| PRINI          | L.    | M | URUQUAY        | H | 203 |
| FELIX          | A.    | M | URUQUAY        |   | 214 |
| BACALLADO      | S.    | M | VENEZUELA      | S | 75  |
| MODESTINO      | M.    | M | VENEZUELA      | B | 126 |
| PATINO         | M.F.  | F | VENEZUELA      |   | 180 |
| PLAZAS         | M.    | F | VENEZUELA      |   | 182 |
| DAO THANH      | H.    | M | VIETNAM        | S | 40  |
| LE HOAI        | N.    | M | VIETNAM        | S | 51  |
| CAO THI PHUONG | A.    | F | VIETNAM        | B | 88  |
| BUI HUU        | T.    | M | VIETNAM        | H | 176 |

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The cooks of hotel Spaander are proud to see that everyone enjoyed the exquisite dinner to the last crumb, even the vegetarians.

## Interview with the Belgian team

Each year, the Belgian team consists of two students from Flanders and two from Wallonia. Because they speak different languages, the contacts between the Flemish and the Wallonians is limited.

Furthermore, the initial selection and training is also segregated in Belgium. Obviously, travelling to the Netherlands is not such a big

deal for Belgians: "In school, they laughed at us for going 'all the way' to Groningen."

Although the exams were tough, they like the Olympiad itself very

much. It is therefore a great pity, said one of the Flemish students, that circumstances will probably prevent Flanders from competing in the IChO as of next year.

## Arbitration

With the marked exam papers on them, the mentors came to the arbitration session at the Martini Plaza conference center on Friday, to obtain the highest possible marks for any of their students who had given dubious answers. They could discuss matters with the members of the jury within fixed timeframes that were very strictly monitored, so that the meeting would not take longer than scheduled. In general, the mentors did not take more time than allowed, apart from a few 'bottleneck' tables, where the debate sometimes became heated and the negotiations were tough (toughness being the privilege of any delegation). The Martini Plaza was certainly an ideal location for this arbitration session: the spacious rooms with their muffled acoustics exuded a quiet atmosphere and allowed the delegations to be placed quite far from each other, so that a tough negotiation style would not bother neighboring delegations and jury members.

### Lessons in Dutch,

### Part 3

- Did you win a gold/silver/bronze medal/honorary award?
- Congratulations!
- Will you go to the party tonight?
- May I take your picture?
- Would you like to be in a picture with me?
- Let's keep in touch!
- I'll call you!
- When are you leaving?
- Have a nice trip!
- Goodbye!

- Heb je een gouden/zilveren/ bronzen medaille/eervolle vermelding gekregen?
- Gefeliciteerd!
- Kom je vanavond naar het feest?
- Mag ik een foto van je nemen?
- Wil je met me op de foto?
- Laten we contact houden!
- Ik bel je/We bellen!
- Wanneer ga je naar huis?
- Goede reis!
- Tot ziens!

## Hello from the Egyptian team

The Egyptian team is just greeting you... and saying Helloooooo!!!! We really liked the Domino game and the strategy game, but we missed a lot the heat of Egypt and the warm days. Whether we win medals or not, we are really happy with the experience, fun and friends we won!

## Did you know that...

- The hotel must have anticipated sleepy students on Friday morning, since they switched the coffee and tea urns at breakfast.
- The Afsluitdijk, the long dike we passed on our way from Groningen to Amsterdam, is mutagenic. According to Peter, the guide of Belgium, this has resulted in special "dike sheep" that have two legs that are shorter than the other. Whether these are the front legs or those on the left side was not clear...
- Aussies can hardly pronounce the typically Dutch "ui" sound. They described their attempts as "spastic," but they finally succeeded.
- The Australians themselves offered up a nice little fact too:
- Next time you have a spare moment, pop along to bus no. 6. The informative fun just never stops, and if you're into dykes, you'd have come to the right place!
- A list of the e-mail addresses of all participants will be made. So please, give yours to the Catalyzer Press!

## Small world

FRIDAY 12 JULY: Iranian student N. Torabi turns out to be the second cousin of University of Groningen staff member Amir Haghghirad. They only found out about this yesterday. This just goes to show again how small the world really is.

## What went wrong?

Obviously, with an event as big as the International Chemistry Olympiad, some things are bound to go wrong:

- The Estonian flag raised during the opening ceremony lacked its lower, white, bar. The reason: the background of the flag shown on the Internet had been white... Please accept our apologies, Estonia!
- Contacts between the students and their mentors are absolutely forbidden as long as the exams have not been taken. One, unforeseen, consequence of this prohibition was that it took an enormous effort to get the Catalyzer copy to the editors on the first few days...
- It appears you sometimes need students to find out that guides are missing. Thank you, Korea!
- One of the hired vans for the scientific committee was stopped by the police because the road tax hadn't been paid. The owner (the rental company) was fined 1,500.- Happily, the driver was permitted to continue his journey...
- Unfortunately, it appeared to be impossible to keep a group of 300 young people quiet at night. We hope that a stern word of warning will make the stay of the non-Olympiad guests more comfortable...
- The program of the participants was so full, that they did not have the opportunity to shop for souvenirs and postcards. Some of the participants even skipped dessert to obtain these valuables...



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