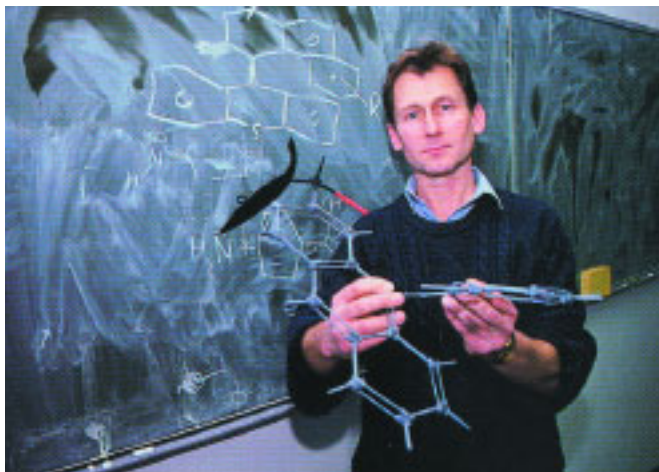




Groningen Chemists Develop a Molecular Motor

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 (10⁻⁹ 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.

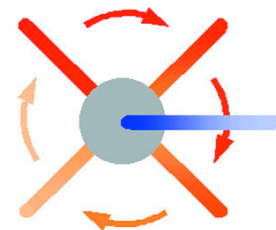
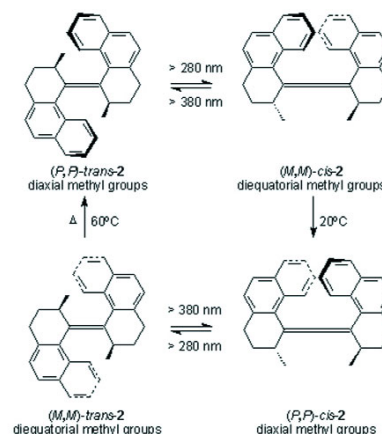
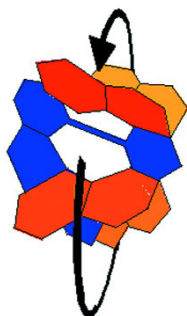


The last person we would like to bring to your attention is Dr Willem van der Veer, who coordinates the organization of the exams.

>> 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

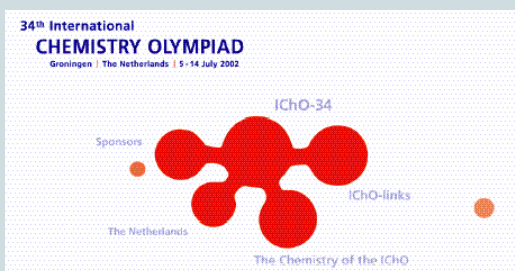
At present, the molecular motors are not rotating very fast — Ferrari has not shown any interest yet. An entire revolution, under close supervision, takes no less than seventy minutes. "It is a primitive system whose underlying principle has only recently been demonstrated," says Feringa. "But now that 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

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, 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	
Fri July 5th	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
Sat July 6th	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				
Sun July 7th	08.00	Translation Practical Examination	11.00	Instruction in Safety practices (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		
Mon July 8th	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-University	10.00-16.00	Lake-tour Friesland
	16.00-18.30	Consultation with authors			18.00	Dinner at hotel
		Theoretical Examination	09.00-14.00	Practical Examination	19.00-23.00	Excursion to Nij Beets
	19.00	Dinner at hotel	16.00-17.30	Sport activities		
	20.00-24.00	Second Jury Meeting	17.30	Departure for Zuidbroek		
			18.30	Dinner at hotel		
			20.00	Lecture on Chemistry		
Tue July 9th	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 and Chemistry'	10.00-19.00	Excursion in Friesland
			19.00	Dinner at hotel	19.15-23.00	Frisian evening
Wed July 10th	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 and surroundings	08.00	Departure for Groningen University	08.00-22.00	Excursion to Amsterdam 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		
Thu July 11th	07.00	Early breakfast at hotel	08.00-10.00	Breakfast at hotel	08.00	Breakfast at hotel
	whole day	Marking examinations or:	13.00-20.00	Excursion 'Mega Olympic Games'	09.00-16.00	Excursion, among others 'Skütsjesillen'
	09.00-16.00	Excursion, among others 'Skütsjesillen'			19.00	Dinner at hotel
	19.00	Dinner at hotel				
	20.00-24.00	Third Jury Meeting (Business)				
Fri July 12th	from 06.00	Early breakfast at hotel	06.00	Early breakfast at hotel	08.00	Breakfast at hotel
	07.00	Departure for Groningen: hotels and Martini Plaza	07.30-22.00	Excursion to Amsterdam and surroundings	10.00	Departure for Groningen hotels
	08.00	Arbitration in Martini Plaza start first group			13.00-17.00	Excursion Groningen and surroundings
	19.00	Dinner at Martini Plaza				
	20.00-24.00	Fourth Jury Meeting: Allocation of medals				
Sat July 13th	08.00	Breakfast at hotel	10.30	Brunch at hotel	08.00	Breakfast at hotel
	09.00-13.00	Free time for shopping and lunch	12.00	Departure for Groningen: Free time for shopping	09.00-13.00	Free time for shopping and lunch
	16.00	Closing Ceremony at Martini Plaza Theater	14.45	Departure for Martini Plaza	16.00	Closing Ceremony at Martini Plaza
	18.00	Aperitif at Martini Plaza	15.00	Rehearsal for the Closing Ceremony		
	19.00	Closing Dinner at Martini Plaza	16.00	Closing Ceremony	18.00	Aperitif at Martini Plaza
			18.00	Aperitif	19.00	Closing Dinner at Martini Plaza
	21.00-24.00	Party	19.00	Closing Dinner		
			21.00-24.00	Party	21.00-24.00	Party
Sun July 14th		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
Fax: +31 (0)598 453831

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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:

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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

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World headquarters
100 Independence Mall West
Philadelphia, PA 19106-2499
USA

Asia-Pacific Rim
2F-A, no. 6, Lane 452, Da Ye Road
Peitou District
Taipei 112
Taiwan

Latin America
Edificio Morumbi Office Tower
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Nijenborgh 4
9747 AG Groningen
telephone +31 50 363 46 15
fax +31 50 363 45 00
e-mail icho34@chem.rug.nl
www.chem.rug.nl/icho34

COLOPHON
Editorial staff
Jan Apotheker, Erik Couzijn, Erik Groot,
Kitty van Gruijthuisen, Eduard Hirschfeld,
Ok Hoelscher, Edzard Krol, Karin de Vries
Graphic design
G2K designers, Groningen/Amsterdam