



**Japan is challenged**  
by systematizing  
chemistry  
for students  
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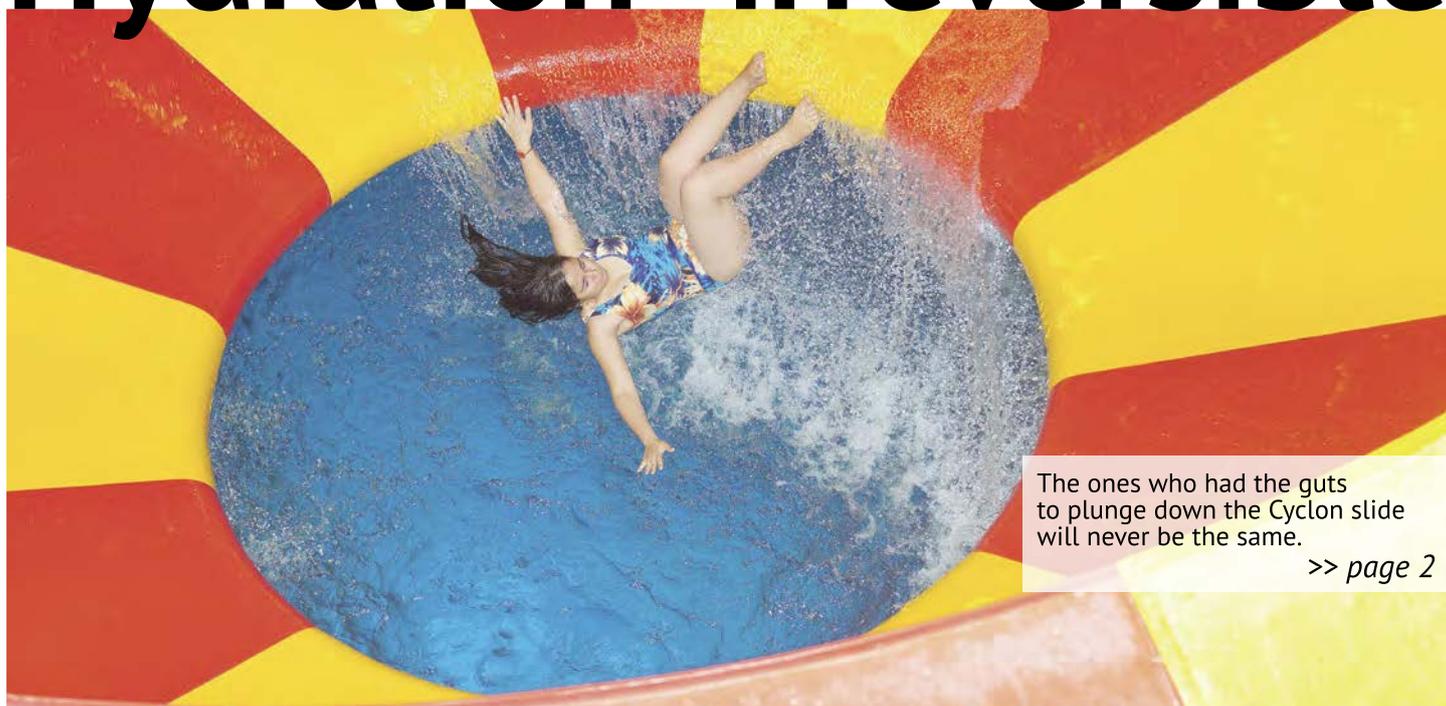


**IChO ex-winner**  
on what  
the future holds  
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**What's money  
made of**  
A 100-ruble bill un-  
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# Hydration irreversible



The ones who had the guts to plunge down the Cyclon slide will never be the same.  
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photo by Alexey Kungurov

## Today is gonna be the last day

8.00-8.30 Breakfast	Russian word for breakfast is "zavtrak" and it's coming from the word "zavtra" – tomorrow.
9.00-12.00 Free time	Those who stay at the hotel are invited to the main lobby at 10 a.m. to learn to play Dixit and Mafia.
12.00 Lunch	We call lunch "обед" [awe-bed] which has the same root as food / "еда". Be careful, leave some room for the evening buffet.
13.00 Transfer to MSU, 15.00 Closing ceremony	This might be your last chance to see Moscow from Vorobyovy hills, the best city lookout.
18.30 Transfer to the Farewell Banquet, 19.00 Farewell Banquet	A Russian proverb says: "You meet people by clothes, but you see them off by their mind". On the first day of IChO we were greeting you with your national clothes. We're seeing you off with regards to your intelligence.

## Catalyzer's Totalizer!

We're about to know the Olympiad results. At that squeaky burn time we asked 38 people about who they expect to win:

- China 25
- Russia 16
- Korea 12
- Chinese Taipei 6
- Japan, USA 2
- Czech Republic, Poland, Hungary, Australia, UK, India, Vietnam, Iran 1

### Individual bets

1. Nikita Shlapakov, Russia (2)
2. Gergo Sale, Hungary (1)
3. Chen Chun-Yi, Chinese Taipei (1)
4. Kairat Ashim, Kazakhstan (1)

### Experimental exam:

1. Russia 2. India 3. China

### Theoretical exam:

1. China 2. Japan 3. Russia

Waiting for the results.



photo by Alexey Kungurov

“Please put on your bathing suits to enter the waterpark! Exception is made for the delegation of Kuwait, they may enter in clothing, which is their bathing suit”. This kind of instructions the IChO teams were getting when approaching the famous Moscow “Kwa-Kwa Park”. Its staff hasn’t yet seen such exotic and elegant bathing suits. **Fatima**

**Azhibek Sabirov**, Kyrgyzstan  
*Though I’ve visited a water park in Tashkent, and the slides are higher there, Kwa-kwa Park in Moscow is also cool. We’ve tried all slides and the most thrilling was the “Cyclon” and the “Black hole” where I could see almost nothing!*

and **Zohra** from Kuwait were fully clothed, including traditional headgear. However, those were real swimsuits, they didn’t prevent the girls from happily chuting down the waterslides.

Meanwhile, the Olympians were forming the interest groups. Most boys started playing horses in shallow water: they sat on each other’s shoulders and tried to pull the rivals off the horses. The

struggle went on with hits and misses until **Josephine Prativi** came up. Catalyzer vividly remembers the Swiss girl playing football the other day, – well, she proved to be even a better horse-rider. As soon as she came to play the guys started falling down into the water.

**Chenmind Tang**, Australia  
*The scariest slide was of course the “Cyclon”, but it was great fun! We tried it once and then we couldn’t stop sliding down again and again!*

Others were diving, swimming, splashing, trying “Wild Rivers”, “Tsunami” and the scariest “Cyclone”. Surprisingly,

among the daredevils trying this last one Catalyzer detected Sona Guluzadze from Azerbaijan, who was diving into a black hole without losing her cute smile and met by encouraging whistles at the bottom. There was an unusual swimmer who (instead of actually swimming and things) was

**Ziqing Liew**, Malaysia  
*There was one slide that was really terrifying, because it was my first one. I fell down into a deep pool and was a bit scared to drown because I am not very good at swimming.*

slouching in a beach chair reading a sci-fi book named “Space and paleontology”. This was Russian **Artem Boychuk**.

Three hours later a good crowd of Olympians gathered in the shallow waters of the pool and was just standing

there discussing something. If it wasn’t for their swimming trunks you could have thought them to be a large group of scientists discussing the problems of modern chemistry. And maybe that’s exactly the way it was...

**Violeta Stojalnikova**, Lithuania  
*We spent all our time in jacuzzi and it was the best part of the whole water park, because after yesterday we were so tired and it was just a great recreation.*

**Koichiro Masada**, Japan  
*Today I swam for the first time over the last five years, so I am both very excited and tired! I really liked the “Black hole”. It was so dark inside!*

## What’s chemistry coming to?

Catalyzer regularly talks to mentors about how they see the present and the future of chemistry, chemical education and the role of their country in the world scientific progress.



Akira Nagasara

Nabuhiro Kihara  
Japan

**Trends and challenges of modern chemistry:** We basically see two direction of chemistry development. One is moving towards biochemistry: we’re currently working on reconstructing complex biochemical processes like artificial photosynthetic systems. The other trend is synthesizing more and more complicated substances.

**Chemistry education:** The science is developing at a fast pace. Our main scientific challenge is educational: preserving what we’ve learnt so far and systematizing it so that it could be studied in the most efficient way. We have to decide what’s the backbone of chemistry and what can be left aside as additional details. With new discoveries every day it’s not as easy as it seems.

**Eastern and Western approach to education:** It seems that European countries are more about discussing the concepts, particularly in the USA. In Japan we’re more about getting knowledge, it’s important, at least at the secondary school. Although higher education is gradually

changing towards this western style.

**The new generation of chemists:** Today’s young people have a lot of ways to obtain knowledge, like Internet, and it’s so different from what it used to be, we need to help them find their way through it.

**What makes a good chemist:** Sadly, there is a lot of failure and defeat in chemistry. A chemist should not give up, but proceed.

**The most famous Japanese chemist:** There have recently been 7 Japanese chemists who were awarded Nobel Prizes. There was Kenichi Fukui who got it in 1981 with his USA and UK colleagues for their theories, developed independently, concerning the course of chemical reactions. There was Akira Suzuki, who was awarded for palladium-catalyzed cross couplings in organic synthesis. There was Osamu Shimomura with the discovery and development of the green fluorescent protein. Together they make up the Japanese chemistry. We can’t really name one.



photos by Alexey Kungurov



# A Country in Brief

Every day Catalyzer picks a random delegation and goes to meet the team.

## FYR of Macedonia

Macedonian team is taking part in the IChO for the first time. These guys are really bright! Their motto is: "Chemistry's everything"!



**Team about Filip Ilievski:** he is a mad scientist. Loves joking. He plays many instruments... mainly imaginary; Filip's dream is to be a football coach. His favorite coach is José Mourinho.

**Filip on his country's contribution to chemistry:** Macedonia is a small country, we're not too much involved in the industry. Still our chemistry is still developing, we're a large center of aluminium production.



**Team about Marija Tepegiozova:** she is an excellent mathematician.

She is funny, she can always cheer us up. Marija is a wingman of our team. She is very caring and reliable. Likes rock and classical music.

**Marija chooses her favorite substance:** well, girls like diamonds and since nothing girlish is alien to me I choose diamonds!

**Marija on her attitude to chemistry:** I passionately love chemistry! It's my life. It explains just how the world around



you functions. It answers many questions that you have been asking yourself all your life. It really intrigues me.

Sometimes he is loud. Macedonians are people who can learn languages very fast, and that's about Gorjan, too.



**Team about Gligor Ducheve:** Gligor is irreplaceable, he knows how to cook, how to iron, how to use all these gadgets. He is the only guy in our team who knows how to do a tie! And – in five different ways!

**Gligor invents infinite power source:** If I could I'd make gas, oil and energy unlimited. That would be very smart and useful!

**Gligor chooses the most typical Macedonian of his team:** I think it's Gorjan. He is very friendly and cheerful.



**Team about Gorjan Stojkov:** the youngest member of the team. Very conscious. With him we're never bored, Gorjan always tells good jokes.

**Gorjan about chemistry education in Macedonia:** chemistry is not very developed in our country. We don't have such long tradition of studying science as you do in Russia. We are relatively young as a country. We start studying chemistry at the age of 13 and keep studying until we are 19. Quite a long while...

## Is there life after IChO?

To find out how the IChO experience can be useful in real life Catalyzer sometimes talks to medal winners of previous years.



**Anton Sinitskiy**

Guide of the US delegation. Won a gold medal at IChO in 1996 and a silver one in 1997. A graduate of the Chemistry Department of MSU, PhD in Economic Sciences, researcher in the University of Chicago.

**It's been a while since you won the IChO, now you're back. How've you been through these 17 years?**

– Amazing things happened. I graduated from the Chemistry Department of MSU and entered Master's program in Economics...

**Economics?**

– I've always taken interest in various levels of matter organization. In chemistry there's a transition from quantum mechanics that describes electrons to the macrolevel dealing with chemical properties of substances. Back then I was interested in the similar transition from technology to social phenomena, which economics is basically all about. So I defended a thesis in economics but soon got disappointed in

this field. You see, the quality of statistical data is often very poor, and you can't use them to validate complicated theories. Chemistry in this regard is far more exact as a science. So I decided to come back to chemistry.

**What did you do to come back?**

– I applied to seven U.S. universities. And you know what really was of help? The fact that I'd won IChO! I can't say they all know it in the US, but 3 universities sent me invitations. And this is how I ended up in the University of Chicago.

**Was it then that you understood what the matter really is?**

– Let's just say we're working on it. We're developing a very new direction in the Center for Multiscale Theory and Simulation. A week ago I was giving a talk at MSU about our research and faced a problem: some of the terms can not be translated into Russian, they have not yet developed equivalents! What we do is take the initial geometry of a certain biomolecule, describe the coordinates of all its atoms basing on the laws of classical physics, and then with the help of a supercomputer we do the forward integration of these equations. Thus we get a model of a system that allows us to predict its behavior. This is done at different levels ("Multiscale"): from single atoms to the assemblies of biomolecules in living cells.

**Did IChO experience help you in life?**

– A lot. The first time I felt it when entering the Economics department. I passed the exam in economic theory better than all entrants with M.S. degrees in economics, because we all had to do our best in 5 hours, to perform at maximum, and I knew how to do this due to the Olympiad. Besides, you know, in modern science (at least in the USA) the supervisor's job is more of doing business: you have to fundraise, work with the human resource, it's permanent multitasking and a lot of independent problem-solving. Again, it's a lot like IChO. So I'd say to all participants: remember this experience, stay in touch with each other. What can help you with this is the Facebook group called "International Science Olympiad" (ISO). I started it to help international competitions participants of different years stay in touch. It already has 3300+ members and you're welcome to join!

<https://www.facebook.com/groups/InternationalScienceOlympiads/>



# Chemical composition

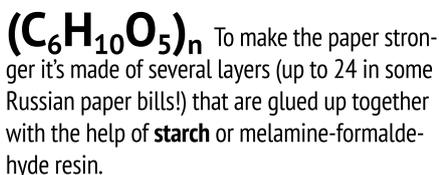
Here's the 100-ruble note, the most common cash in Russia.

Russian paper notes bear the images of big Russian cities and thus are all symbols of Russia. For example, a 50-ruble bill depicts Saint-Petersburg, 500 rubles show Arkhangelsk, 1000 rubles have Yaroslavl on them, a 5000 note shows Khabarovsk. The nominal value is not related to the size of the city, so 100 rubles represent Moscow, particularly the Bolshoy theater as one of its famous sights.

As you might know, the actual chemical composition of national money is always a state secret. Still there are some curious things to know about the chemistry of Russian money.



Today Russian notes can stand 4000 folds (and the new 2010 thousand bills as much as about 10,000) and are not afraid of up to 19 chemicals, including alcohol, **acetone**, turpentine and chlorine.



## Making Money



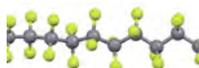
One of the closely guarded state secrets is the composition of money paper. Each country has their own recipe. While the EU money is made of cellulose and the U.S. make it of a mixture of wood and plastic, in Russia we add **cotton** and ship hemp.

## Nd:YAG

The latest innovation of Goznak (national banknote and security printer) applied in Russian banknotes is micro-perforation, which means punching small holes in the paper so that it stays smooth. It's done with **laser** and allows to define the authenticity of the bill even in very little light.



Cotton and linen fiber has little acid and therefore fades slowly. The cloth is soaked in **gelatin** for greater strength. The average life of such notes is two years.



In modern rubles the name of the Central Bank of Russia is done in microprinting with the help of **polymer fiber**. The formula is kept in secret, and the method was considered the most reliable until money forgers learnt to copy it by the end of 2000s.



Money bills of almost all countries (except the U.S.) are multicolored (on average 10 colors). Among the special types of ink there are magnetic ink, fluorescent ink containing organic **luminophores**, phosphorescent paint and the type of ink absorbing or reflecting infrared radiation.

# Meet Russian Chemists



**Vladimir Ipatiev**  
(1867-1952)

## First steps in chemistry

On the sixth year of school Vladimir read about chemical phenomena in a textbook of physics and was shocked: "It was like I looked at the world with the eyes open for the first time, I felt the desire to learn and understand it better".

## Contribution to chemistry

Military chemist, the founder of the whole chemical industry of the Soviet Russia. Considered to be the author of the multi-component catalysis method as well as the heterogeneous organic catalysis under high pressure (1900).

Discovered the reaction of synthesizing cyclopropanes (1901, Ipatiev reaction). Discovered the way of getting butadiene from ethyl alcohol (1909), was the first to carry out ethylene polymerization (1913).

Since 1930 lived and worked in the United States, where he has made a great contribution to the development of the oil industry. Became one of the founders of petrochemical industry.

## Fact

In 1937 Ipatiev was chosen "Man of the Year" in the United States. In 1942 his colleague R.Vilshetter said: "Over the entire history of chemistry there has never been a greater man than Ipatiev".

**Quote:** "I'd like to see every chemist who works under my direction having two problems, one for the company, the other for his own "chemical soul".



Countries saying goodbye the evening before the Closing ceremony



150 Years  
Science For A Better Life



## Contacts

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