

On Science of Chemistry

An interview with Prof. Nikolai Platé
Vice President of the Russian Academy of Sciences

Professor Nikolai Platé, Vice President of the Russian Academy of Sciences and a world renowned scientist, came to London recently.

Nikolai Platé, who specializes in chemistry, is widely known for a number of discoveries he has made in the field of membrane conductivity and the development of non-conventional fuels. In particular, he came up with novel techniques, superior to anything used before, to destroy the enormous stocks of chemical weapons existing in the world today.

Professor Platé visited our office and had a talk with the Herald of Europe's editor-in-chief, Prof. Michael Borshchevsky.

M.B. Dear Professor, I am so glad you have found the time to call on us and share your ideas about the role of science in society today, and I thank you for coming. Our magazine is very much in its infancy, and our goal is to provide a forum in which intellectuals, from European countries and the world at large, can exchange views on the greatest challenges facing the world today.

If you agree, I would like our conversation to focus on two groups of subjects. The first I mentioned briefly just now, that is, your perception of the role of intellectuals in the progress of contemporary society. I don't mean the intelligentsia, but intellectuals.

N.P. Reasonable enough.

M.B. Intelligentsia, I'm certain, is a completely different, innately Russian idea that goes back into the 19th century. The role of intellectuals in today's economics, politics and society generally is visible in virtually all countries. Why is it in decline, particularly in relation to the shaping of public opinion? This is one group of subjects. The other relates directly to your work on membranes. I have a few questions to ask you about them, even if I know little about them.

N.P. Go ahead, please.

M.B. Well, you are certainly an eminent member of the Russian intellectual elite, and this, I imagine, plays a not insignificant part in your sense of identity. Really, it's important to each one of us how we see ourselves, in the context of society. What do you think is happening today to the concept of 'intellectual' in, say, Russian politics? Whenever you turn on the box, you see a bunch of characters, from politicians like Mitrofanov or Zhirinovskiy to half-baked journalists prattling pathetically about problems they know little or nothing about. All this leaves the public terribly confused. We rarely hear the sensible, calm and balanced views of educated and intelligent people who know what they are talking about. Would you give us your view on this problem?

N.P. What you said about Russia is really more than a Russian affliction. It actually plagues the whole of Europe. There are several European science forums addressing the role of science and its relevance to economics and to the intellectual standards of member states and the European Union. Quite a few French, German and British scientists who attend these European forums complain con-

stantly that their voices are not heard by the people making policy at government level, Presidents, and so on. This seems to be a growing trend in both the European Union and the European nations that have yet to join. Where should we look for its roots? To my mind, one of the reasons is rising living standards throughout Europe. If you have followed developments in European countries over the past 20 to 25 years, you will have to admit they are pretty high. Take any country, Holland, for example. More than 12 per cent of its working age population is unemployed, and yet you don't see street demonstrations or protest marches, or anything like that. This seems to indicate that the government's social support is so generous that people can choose to live on welfare benefits. It's not that they live like millionaires, but they don't have to go begging in the streets. To live like this, people in Europe are obsessed – some with consuming, and others with helping them to consume. In the past five to ten years in Russia, we, too, have been turning into a society of consumers. We see how people are wooed and coaxed into never-ending expenditure, for cash or on credit, or by whatever means they can, going on a spending spree, simply to make themselves feel good. Look at the fantastic number of glossy magazines all across Europe ... and the mass advertising that you simply can't escape from.

M.B. Recently, last week, to be exact, I was flying back from Spain. Before I boarded my plane I bought a special edition of *The Economist*, attracted by its cover title, 'Intellectual Life.' What do you think I found inside? Tips on buying a car, decorating your home, and much more in the same vein.

N.P. This is a good illustration of what I've been saying. The corollary of this is that people have lost any sense of purpose in their lives, or of what 'intellectual' is about. Another reason for the lack of intellectual input is that current policymakers and decision takers in general are not necessarily people with a broad education and a thorough knowledge of the history of human civilisation.

M.B. An extremely dangerous situation in the modern world, with its advanced technologies and globalization.

N.P. You're right. It's a great hazard. I'd say it's more serious than that. This is a trend, and it has accelerated out of control. If we live in a consumer society, we have to resign ourselves to external policy decisions being influenced, directly or indirectly, by people who excel, in the proper sense of the word, in market economics, balance sheets, revenues, risks, prices, and so on. But turn it around, and think what you make of the buzz stirred up when a global business organization named as the world's most successful businessman, an American, who had floated nearly five hundred companies over a decade. He started out by collecting and incinerating garbage, raking in piles of money. Fine, big money is good. But it can't be raised without auto concerns, without Siemens or Philips, Aerospatiale, or other similar European businesses. Life would certainly be far less comfortable without many technologies. But it's people in Big Business who make the political decisions. Either that or professional politicians who long ago lost all sense of the difference between cause and effect in economics, politics or social justice.

M.B. Could you, please, speak about the analytical situation in today's Russia? Don't you think the role of intellectuals in political and economic policymaking there has declined, as it has elsewhere, from what it was for decades under the Communists?

N.P. True, the centralized government back then always kept its ear tuned to the voice of experts, above all scientists in various fields. In making political deci-

sions, though, it certainly ignored the opinions and role of the most educated section of society. These days, the academic community in Russia is almost never called in by the authorities to air its views, even though scientists of the Russian Academy of Sciences masterminded and wrote our current Constitution. That was their hour of glory. Since then intellectuals have been banished to the sidelines. Take this simple example. Social scientists would have had no difficulty in predicting the wave of social protest that was triggered by replacing social benefits in kind with cash allowances of a much lower real value. That's one example. A second example turns my stomach just thinking about it. It's Russia's policy, every aspect of it, in the North Caucasus. Couldn't they have brought together historians, ethnographers, and experts who understand its culture and religion, the trends in Islam and the history of the Caucasus from hilltop-dwelling tribes down to Imam Shamil in the 19th century? Why couldn't they ask those people to advise them on the policies to be followed there?

M.B. You know what makes me angry? Galina Starovoitova, who was an ethnographer, spent half her life in the Caucasus. She knew many people there personally. At one time, she was President Yeltsin's adviser on ethnic policies. Duty took her three times to Chechnya for talks with its President Dudayev. The last time she came back from there, a month before her dismissal from office, she wrote an analytical memo to Yeltsin, with a warning about what war in Chechnya could precipitate, and how such a war could be prevented. It involved nothing more than giving to the Chechens what people in Tatarstan had then, and have now.

N.P. May I add a kind of follow-up? The academic community, the community of experts, at any rate, is increasingly losing weight and influence. We see this from your two examples, monetization of fringe benefits and Russia's policy in the Caucasus. And even more in its policy toward its other CIS sisters. Wasn't it as clear as day with the Ukraine or Kyrgyzstan? In Moscow they knew, and realized they had a crisis on their hands, and yet they were deaf to reason, and listened to a small group of people who had their own axe to grind. And now we are throwing up our hands in despair, 'How did that happen? How could it all have gone so wrong?' It's a pity no lessons have been learned, to avoid mistakes on projects that are now winding their way through government and the higher levels. Construction projects are a case in point. We all remember the dam at Leningrad, or the story of the Solikamsk integrated works.

But this is a diversion, so let's go back to our main subject. From the philosophical point of view, where is it that many young, and not so young, reformers in power today are going wrong? In deference to business, and all things new, Putin proclaimed, and rightly so, 'We have opted for innovation. We are building our economy around high technologies.' Many people with power today come from the world of business. They evaluate scientific knowledge in the same way as they do ball bearings, gear-boxes, or chips for computers and smart cards. That is to say as something which has a market value attached to it – a commodity to be sold or commercialized. Never in the past, not in the 18th or 19th centuries, when economic progress was much more leisurely, nor even in the 20th century, has the product of scientific endeavour been assigned a market value. It is wrong to try to evaluate science in terms of results. The current philosophy cobbled together at the Ministry of Education and Science puts it simply enough – the work of research institutions should be geared towards an end result. It's not hard to

extrapolate this. Let me hypothesize a little. Let's imagine you and I are at the Astrophysics Institute, and we have set ourselves the task of discovering a new star in the constellation Cassiopeia or Taurus. We failed; so what? We bungled our task after three years of effort. The boys upstairs think we have misused government money and have to be axed.

M.B. You remember, of course, that attitudes like these sprouted while the Communists were still at the top, and often, even more so over the past 20 years, purely scientific research has been pushed onto the back burner.

N.P. The situation looks darker today. You are now required, whether it's possible or not, to prove your research has a sales value. Something you can't do in basic sciences.

M.B. How can this be countered?

N.P. As I see it, two things are needed. First, overzealous reformers in science need to be booted out. That's the first and it's a government prerogative. Second, science needs to be promoted to a much wider public. Too many people, both in Russia and in Europe, think they live in an ivory tower. Ordinary people, whether from Namur in Belgium or Kostroma in Russia, need to be reminded, from time to time, that without the great fundamental discoveries that were made many years ago, they wouldn't now be able to turn on their radio, let alone have a modern-day television or mobile phone.

M.B. A recent poll produced the curious finding that between 35 and 40 per cent of European university graduates didn't know why we have seasons and why they follow one another the way they do.

N.P. Or day and night, either? No. This is a sign their educational system is in big trouble. Another serious flaw of the modern educational system is that many scholars cannot explain simple things in simple language. They are good in their discipline, like mathematics – pure or applied. They shine in their own field. Let me say in passing, the Russian school of mathematics is still the best in the world. Believe me, I speak with knowledge. Between 45 and 48 per cent of maths teachers at American universities have Russian backgrounds. I am a member of the European Academy and represent the Russian Academy at the association of European academies. The issues we are talking about have been discussed exhaustively many times at the UNESCO Commission and in the Twelfth Committee of the European Commission. They have both aired exactly the same complaints. Just look at booming pseudosciences, from astrology to torsion fields, magnetic super-effects, bioeffects, and much else, that are often a cause of death – that can have disastrous effects. We must make the public aware of the consequences. We have to do this, and, in my view, we have to follow an all-out aggressive policy against pseudoscientists spreading disinformation. They are ruthlessly aggressive plying their trade, and we have to be equally aggressive in response.

M.B. I fully subscribe to your view. Could we turn this subject around and look at things from the vantage point of your direct pursuits? They are absolutely intriguing and highly interesting to me. You will excuse me, I hope, if I put my question inexpertly.

Clearly, the world economy of our day depends on oil to survive, and you, among other people, have spoken on many occasions about several new kinds of fuel, more reliance on natural gas, and many other such things. For myself, I remember attempts were made in the late 1960s and early 1970s to separate water into hydrogen and oxygen and to use hydrogen to power cars, for example.

N.P. Still earlier attempts at this are on record as well. Nothing to be surprised at here, deriving hydrogen and oxygen by water electrolysis.

M.B. The drawback was high costs of electrolysis itself and the reagents needed.

N.P. It was indeed about high power inputs and low outputs.

M.B. Exactly. Is this a challenge that we still haven't met to this day?

N.P. Happily, we have.

M.B. But then you have the oil lobby which is strong enough to prevent its commercialization, and other contrary factors.

N.P. It's not just the oil lobby. But the idea of hydrogen power engineering will gain recognition in any case. Enormous funds, many billions of dollars, have been sunk in conventional fuel production, and oil producers, refiners and investors are not entirely to blame for the foot-dragging we see. Hydrogen power engineering must be many times as economically effective as oil is, not just 10 or even 20 per cent, to turn energy tradition around and force governments to review their energy policies. What governments can do now is toughen their environmental regulations. No one is going to change to methanol or dimethyl ether, or hydrogen, unless they have no choice.

M.B. Or unless oil prices skyrocket making them too high for other industries to afford.

N.P. You're absolutely right about that. That's one consideration. We must have laws to ban uncontrolled emissions into the atmosphere. In Moscow, we have an exceptionally large number of polluting trucks, buses and other vehicles. How far advanced are we in technological terms? For all I know, it may be impossible to use hydrogen fuel in all motor vehicles; some of them will always have to run on gasoline. Hydrogen has greater promise in power generation, and power plants are giving it close scrutiny. Particularly, small power plants.

M.B. Small plants and those on the shoreline, I would say.

N.P. Shoreline generation is another story. There, you have many choices – wind and tidal power which are there for the taking, for example. Also there is a huge niche market to be developed, where Russians and Americans have been making great strides. Starting with the manufacture of mobile, small power cells, to replace lithium, cadmium, cobalt and other cells. Not with solar cells, no. The problem is though that hydrogen itself is not very handy. We have to find a workable system for use with mobile and small devices. Mobile applies to more than just mobile phones. It is any electronic gad-get or mobile device such as a small television set, or anything of that sort. What's important is that it has to function at room temperature, say, 20 degrees centigrade, and be small, and environment-friendly. Whenever pure hydrogen comes up, we always think it has to be compressed and rechargeable. In fact there is another point at issue. We need a harmless, low-toxicity, environment-friendly hydrogen-containing liquid fuel that starts to release hydrogen at the touch of a button. This is where membranes come into the picture. When you press a button for hydrogen to be released, air starts to flow through the membrane that filters out the nitrogen, and passes on oxygen that interacts with the hydrogen in a reaction that transfers two electrons and releases heat.

M.B. Are there any reagents available today that make this reaction economically viable?

N.P. Up to now it's still pretty expensive. Toshiba of Japan have started to produce notebooks you don't have to plug in anywhere, and they don't have to be powered by heavy batteries. Instead, they have a small box the size of a liquefied-gas cigarette lighter, the kind we happily carry around with us all the time. So this LG box, it's filled with methanol, a compound of one carbon atom, four hydrogen atoms and one oxygen atom – CH₃OH. The gas breaks down easily on a catalytic membrane into its three components, and hydrogen bonds to oxygen. Quite expensive, I'd say. But remember we're looking at a global market of a billion users. It's a challenge we have taken on at the Academy of Sciences.

M.B. Another question, if you will. In your recent interview with *Literaturnaya Gazeta* you touched in passing on compression of elements used in chemical ammunition to destroy enormous quantities of chemical weapons in an instant.

N.P. Actually, the elements I used are not those found in chemical weapons. We put forward two simple ideas. There are two types of very powerful engines that are used around the world to produce mechanical traction. Diesel engines propel ships and locomotives, and, of course, motor vehicles, from heavy trucks to mini cars, and liquid-fuelled jet engines. Fuel is burned, and the powerful thrust it generates drives the crankshaft, power train, wheels, whatever. As I pondered on this, I asked myself one day, why are we fixated on mechanics, dynamics, kinematics in general? The ideal thing is a chemical reactor. Why not use it to incinerate chemical agents, instead of turning shaft and wheels? Put the jet or diesel engine on the ground and fix it the way they do at diesel-driven power plants – it doesn't move there, but turns a shaft to drive a power generator. With us, it only needs a few microseconds to produce a very clean and fine chemical reaction, and temper, cool and freeze reaction products, which always end up in an averaged equilibrium in a regular chemical reactor churning a homogeneous gaseous mixture. Here, though, we get fragments that we cool immediately so they don't have their original reactivity. We can increase output many times over, from only a few percentage points they get in averaged conditions. What we get now is that high temperatures and pressures in the reaction chamber of a liquid-fuelled jet engine, souped up only insignificantly, destroy extremely toxic agents, including nerve gases, completely. At the end of the line, we get harmless products – hydrogen chloride, water, carbon dioxide and phosphorus pentoxide, good enough to be used as fertilizer, all of which give no problems to chemical technologists. This is now part of our national programme for the destruction of chemical weapons.

M.B. Are the governments of developed countries that possess enormous stocks of chemical weapons ready to start their destruction?

N.P. I wouldn't describe the stocks as 'enormous', at least as far as Russia is concerned. Russia has 40,000 tonnes of this stuff – not really very much.

M.B. What about America? Or China?

N.P. The US has 36,000 tonnes, and China none. China has no chemical weapons. Europe used to have American chemical dumps, in Germany. All have been repatriated. Continental Europe is now clean. There are some in Britain. France has burials of mostly German chemical ammunition, artillery shells, in fact, dating back to the Great War. Negligible quantities, indeed.

M.B. Are, say, the British or French ready to destroy their stock?

N.P. It's more definite than that. It all falls under an international convention, which, fingers crossed, is closely complied with and monitored by all nations. It is not a question of readiness. We, for our part, have much to do at home.

M.B. One last question. How long will it take to destroy all that stuff?

N.P. The convention sets the year 2012 as the deadline. And it will be met.

M.B. I want our next issue to focus on European science, and its influence on society and the European Union. We hope to examine its current state of health, general trends and future developments.

N.P. From what you say, an in-depth study of this subject should be published in the not too distant future. Russian science tends to receive a bad press from the European media. This is partly a short-term view because not everyone sees advantage in Russia being strong in the sciences. Despite the changes since 1991 there are still those who see Russia as the 'bad guy' bent on destruction. Our science sector has always been strong in many fields – not only in defence. Some people would like to see it disappear as part of an outmoded system. So it's no surprise to see, in the press, analytical articles about science with an anti-Russian bias. From discussions in Brussels and Paris I have become aware of the extent to which people have been inundated with one-sided information.