SCIENCE FEMININE GENDER

On November 12, 2008 in Moscow ten young Russian scientists of the fair sex were presented with the RUR 350,000 L'OREAL—UNESCO For "Women in Science" award

The L'OREAL—UNESCO award has been granted for the second year running. This L'OREAL project is supported by the national UNESCO Commission, UNESCO Bureau in Moscow and Russian Academy of Sciences.

The applicants should be not older than 35 years. The major selection criterion is citation index; also, the jury takes into consideration the originality of the scientific field, personal contribution to the research done, involvement in the activities of the affiliated research body, and finally, the candidates' intention to continue their academic career in Russia.

This year, 320 young women from 65 Russian cities (twice the last year's number) competed for the award. Decision was made by the jury of eight people—it included L'OREAL and UNESCO representatives and was headed by the Vice-Rector of Moscow State University Academician A. R. Khokhlov.

The winners of the competition became ten young women engaged in chemical, physical, and biological research.

Two of them are our heroines: Siberians Oksana Kaliuzhnaya (Irkutsk) and Sofia Artemkina (Novosibirsk).

Underwater miracles of Oksana Kaliuzhnaya

The object of Oksana Kaliuzhnaya's studies is not quite ordinary: this is *sponges*, the most ancient multicellular organisms living. Most species of these remarkable invertebrates, looking more like plants than like animals, live in the seas but some prefer freshwater habitats such as Lake Baikal.

Interestingly, Baikal sponges are *endemics*, that is, they are not found anywhere else in the world. Judging by the spicula—sponge skeleton elements—discovered in the Baikal sediments, sponges are Baikal natives. They have occupied a variety of ecological niches in the planet's largest and most ancient lake, which has resulted in explosive speciation. And they look good too: most Baikal species are quite big and some of them are branchy.

For many years, sponge studies have been no more than 40 meters deep, i.e., as deep as divers can reach. In shallow water, sponges spread their green carpet over the bottom, but what happens if you go further down?

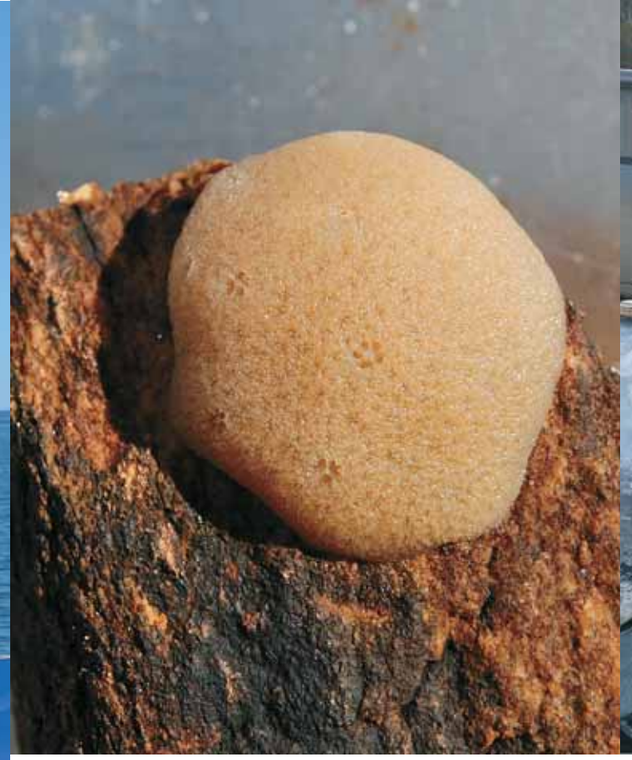
Oksana KALIUZHNAYA is a candidate of biology and research worker with the Limnological Institute, Siberian Branch, Russian Academy of Sciences (Irkutsk). Her interest is molecular-biological research of Baikal sponges. She took part in the international Mir on Baikal—2008 expedition and twice submerged to a depth of 1,576 and 1,370 meters. Her hobby is scuba diving

When the legendary Pisces apparatus submerged in 1977 and 1991, the researchers first saw deep-water sponges of a rare blue color. In 2008, the first international expedition in which Mir deep-water apparatus was used was held on Lake Baikal. The Limnological Institute of the Siberian Branch of the Russian Academy of Sciences participated in the expedition, and Oksana's dream came true: together with other young scientists, she became a member of the expedition and took part in two (out of 30) Mir submergences. Among other things, the expedition has produced a good collection of deep-water sponges.

As a molecular biologist, Oksana is primarily interested in the genes responsible for forming the sponge skeleton.

The mysterious "blue sponge" was first discovered deep down in Lake Baikal back in 1977 by the crews of Pisces apparatus, but only last summer the scientists managed to get some samples of these sponges

Oksana Kaliuzhnaya before submerging in the deepwater Mir 1 apparatus. Baikal, 2008



The unknown species of deepwater sponges Mir brought up from Baikal depths

Oksana sets off to the floor of Baikal to chase the subjects of her studies any time of the year

The extraordinary inner skeleton of these ancient animals is built up from small solid needles (spicula) consisting not of calcium but of silicon. Oksana and her colleagues were the first to prove that freshwater sponges, in contrast to the sea ones, have a lot of genes responsible for spicula formation, their shape, size and other features.

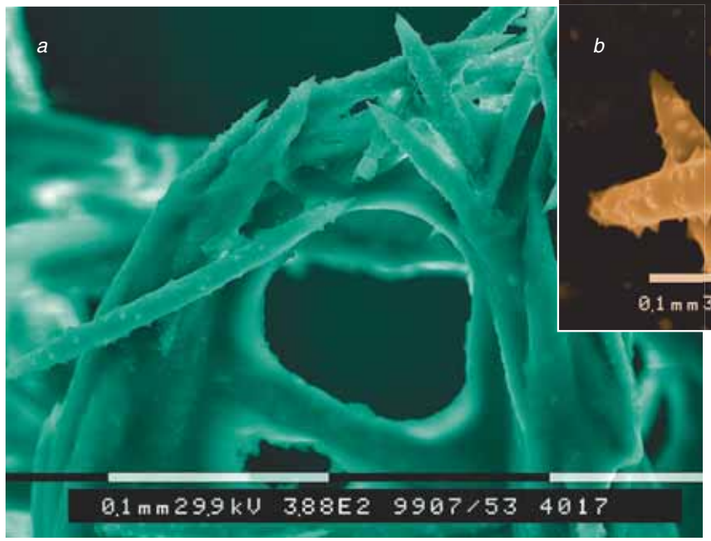
Of great interest are sponges' symbionts, that is, bacteria and algae that dwell in the hollows of their bodies. Sponges living at the depths up to 100 m, where the light can penetrate, include photosynthesis organisms and are hence green. It is the symbionts inhabiting in colorless and blue sponges picked up over 1,500 m depths that have been investigated by the Limnological Institute researchers.

Today, sea sponges are being studied intensively as sources of biologically active substances including the anti-cancer ones. Freshwater sponges have not been explored at all in this respect, but Oksana hopes that future molecular-genetic research into Baikal sponges (or their symbionts) will produce some substances with therapeutic applications. The above-mentioned study into the mechanism of the sponges' silicon skeleton formation, which may seem to refer entirely to basic science, might unexpectedly appear to be of practical use. Importantly, sponges build up parts of their skeleton from silicon nanoparticles of a certain specified structure, and this is a genuine find for modern bio- and nanotechnologies.

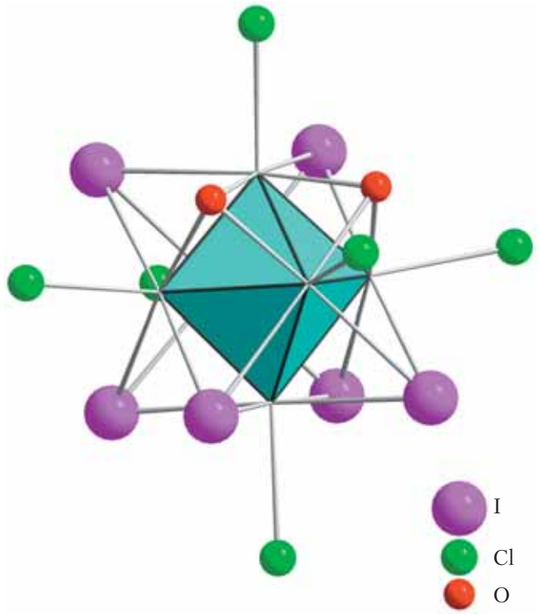
So far, Oksana calls such speculations dreams. She is carried away by her routine work involving expeditions, where she can combine her professional interests and her hobby, scuba diving. She is anything but an armchair scientist: she first meets the subjects of her studies not sitting at a desk or looking through the microscope but in clear waters of the lake. And if we bear in mind that Baikal is far from the Mediterranean the average water temperature there is 4° C and sometimes samples have to be gathered in the winter we will see that the "extraordinary sensation" our Baikal mermaid experiences underwater may be beyond the powers of many representatives of the stronger sex.

Have a good journey, Oksana!

Baikal sponge skeleton (a) consists of separate silicon spicula (b). Electronic microscopy. Limnological Institute, Siberian Branch, Russian Academy of Sciences (Irkutsk)



Photos by V. Korotkokuchko and from the archive of O. Kaliuzhnaya



Structure of the cluster complex $\{Mo_6I_6O_2\}Cl_6$ (molybdenum atoms at the apices of the blue octahedron are not shown)

Sofia ARTEMKINA, a candidate of chemistry, is a scientific researcher at Nikolaev Institute of Inorganic Chemistry, SB RAS (Novosibirsk). Scientific interests: studies on synthesis of cluster complexes. Non-scientific interests: family, needlework, and winter sports

Woman-made crystals of Sofia Artemkina

Sofia Artemkina has been involved in cluster chemistry ever since her student days at Novosibirsk State University. Her graduation project, performed with the laboratory of Professor Vladimir E. Fedorov, was dedicated to the compounds of rhenium, a metal that has not been adequately explored yet. After graduation, she continued working at the same laboratory of the Nikolaev Institute of Inorganic Chemistry (Siberian Branch, Russian Academy of Sciences), completed her postgraduate studies and received her candidate's degree.

The young chemist focused her investigation on *cluster compounds*, which is the chemical term for complexes consisting of a group of covalently bound metal atoms encompassed with various ions and neutral molecules — *ligands*.

In the recent years, Sofia has been studying octahedral clusters—mainly molybdenum, niobium, and tantalum compounds. The research team she is a member of has succeeded in synthesizing a number of completely new chemical substances.

They were the first in the world to obtain such complexes as $\{Mo_6I_6O_2\}Cl_6$, $\{Mo_5NbI_8\}(OH)_6$ and some others.

Why would people need them? Sofia modestly refers to these compounds as "quite interesting" and avoids indicating specific areas of their potential application. Such attitude is in the tradition of Russian basic research: first something new is discovered, then it is thoroughly explored, and whether it will happen to be of any practical value is a matter of time. A true scientist is driven by the thirst for the unknown, curiosity, and desire to set foot in the area nobody has yet visited.

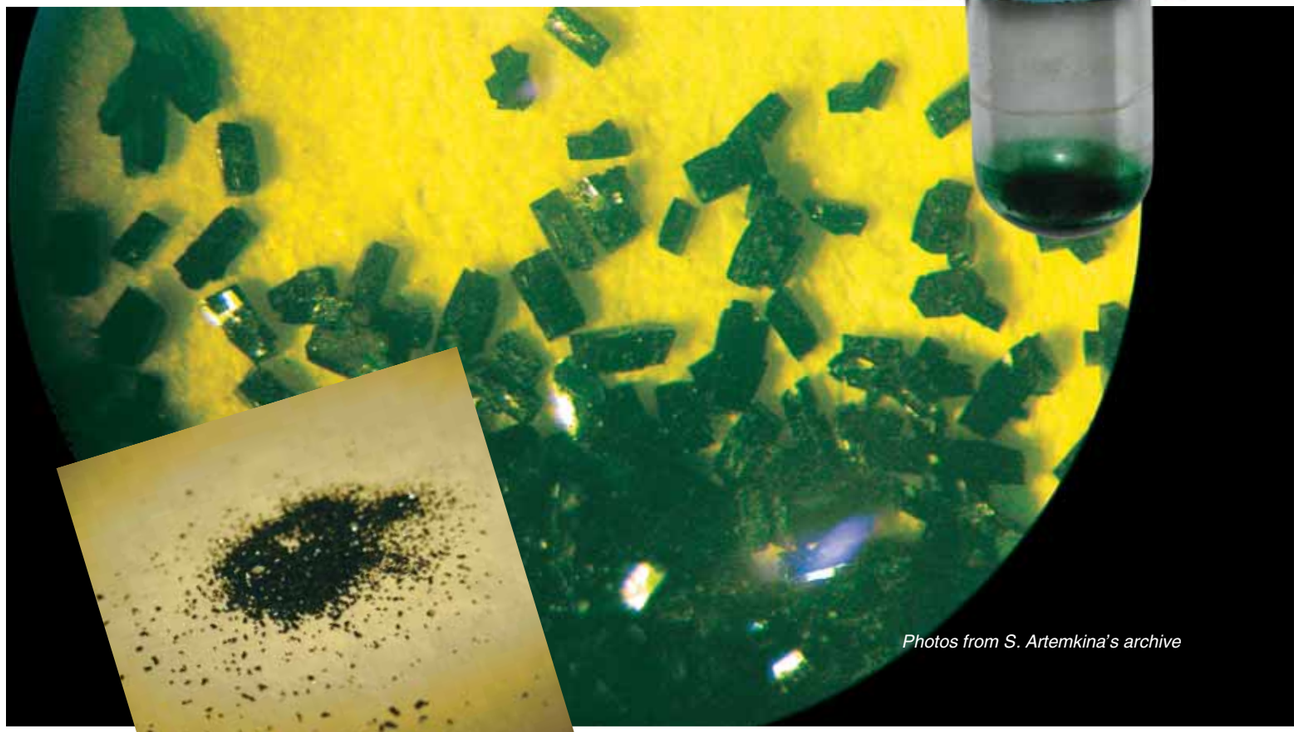
This is what Sofia Artemkina and her colleagues are up to: deriving new complicated compounds, investigating their chemical conversion (for instance, reacting cluster material with an agent so that the cluster will remain the same whereas the ligands will be replaced), exploring the crystal structure and physical properties, and improving the synthesis techniques with a view to producing these substances in amounts sufficient for basic research.

Along with the laboratory of the Institute of Inorganic Chemistry, teams all over the world are carrying out research into the synthesis of cluster compounds and materials, and Siberian publications are referred to fairly often, which testifies to their high academic reputation. Let us note, for the sake of impartiality, that the news recently spread by certain mass media that thanks to the pioneering studies by S. B. Artemkina medicine has a chance to find a cure against cancer has nothing to do with reality. According to Sofia, these conjectures made up by careless journalists are a far cry from the real situation.

The future will show what applications the new cluster complexes created by Sofia Artemkina may have, and for the time being let us just admire the fact that this charming, attractive and intelligent woman gives life to something utterly new, and does this with enthusiasm and elegance—as is proper for a woman...in science.

Schlenk vessel is used to carry out chemical reactions in a controlled atmosphere. To synthesize tantalum cluster compounds, the volume above the solution was filled with argon

This is how the dark green $Cs_4Ta_6Br_{12}(NCS)_6 \cdot 0{,}5H_2O$ crystals look



Photos from S. Artemkina's archive