

Irina P. Beletskaya. Biographical Sketch



Irina P. Beletskaya was born in Leningrad (St.-Petersburg) on March 10, 1933. After graduating from the Department of Chemistry of Lomonosov Moscow State University (MSU), she started her brilliant lifelong career at the Department and since that time her life is tightly linked with this establishment. The onset of her academic carrier was swift and spectacular. Having obtained her PhD degree in organic chemistry under supervision of Prof. Nesmeyanov in 1958, she reached the Dr.Sci. degree by 1963 when she was only 30 years old, and soon after that became a renowned scientist at the Department of Chemistry. Besides intensive research, Irina Beletskaya was always engaged in teaching, and since 1971 she has been serving as a professor of chemistry at the Department giving lecture courses on general organic chemistry and special postgraduate courses on organometallic chemistry and transition metal catalysis.

Her initial research efforts were directed to the study of reaction mechanisms. What Hughes and Ingold did for nucleophilic substitution, Irina Beletskaya together with Prof. O. Reutov did for electrophilic reactions at saturated carbon. She was the first to thoroughly investigate the mechanisms of reactions of organometallic compounds, revealing the regularities of S_E pathways in a set of articles and a monograph. In this period she also elaborated one of the earliest CH -acidity scales based on correlation with electrochemical data and vast exploration of the reactivity of carbanions. Later the mechanistic studies involved the investigation of the mechanisms of nucleophilic aromatic and vinylic substitution, including a research devoted to special mechanisms of substitution reactions involving organometallic supernucleophiles.

Prof. Beletskaya was among the first to pay attention to the application of rare earth elements in organic chemistry. The synthesis of novel organolanthanide complexes was developed including Grignard-like organoytterbiums and similar compounds, which turned out to be useful reagents in organic synthesis. Other lanthanide complexes were shown to take part in various highly effective catalytic processes, *e.g.* hydrosilylation, hydrogenation or oligomerization of olefins.

In the 70s Prof. Beletskaya, again among the first, realized the huge potential of a new field, that is, the

application of transition metal catalysts in organic synthesis. She initiated the studies of palladium and nickel-catalyzed reactions, and developed a number of convenient protocols for C-C and C-heteroatom bond forming methods. Industrially important methods were thereby developed for the alkoxy-carbonylation of aryl and benzyl halides.

The studies of the catalytic activity of various palladium complexes and the regularities governing catalyst deactivation brought forward an unusual idea of ligand-free (or phosphine-free) catalysis. The catalysts lacking strongly bonded ligands showed much higher activity in C-C bond forming reactions involving organoboron or organotin compounds. Further studies revealed a key role of water as a solvent for palladium-catalyzed reactions. All these findings put together afforded a general approach of aqueous phosphine-free catalysis. Huge catalytic efficiency, very mild conditions, simplicity of experimental setup characterized the processes realized within this fruitful methodology.

Well in advance of the burst of global interest in environmentally benign (“green”) chemistry, Prof. Beletskaya discovered a series of transition-metal catalyzed reactions in aqueous media, including unusual systems such as microemulsions or other high-capacity solubilizing media. A thorough study of aqueous phosphine-free catalysis helped to reveal yet another essential feature – the involvement of catalyst nanoparticles, which not only allowed the development of new catalytic systems (for example, a new series of palladacycles involving cheap CN-ligands), but also explained the catalysis by super-low amounts of phosphine-free palladium catalyst.

Amazingly, in the 1990s, in spite of harsh economic problems and huge cuts of support for science, the activity of Prof. Beletskaya in research progressed at an increasing pace. Her current interests are as broad as ever, including organometallic chemistry, catalysis, supramolecular chemistry, nanochemistry, synthetic methodology *etc.* Besides experimental research Prof. Beletskaya is very interested in methodology. There appeared and continue to appear, a vast series of highly acclaimed critical reviews and book chapters on various aspects of palladium and other transition metal catalyzed reactions, including the Heck

reaction, C-C and C-heteroatom cross-coupling, addition to double and triple bonds, carbonylation and carbonylative cyclizations, water in organometallic chemistry, and dendrimers. In two last decades her scientific interest also covers several additional fields: chemistry of macrocycles and their use as chemosensors, porphyrin chemistry, organocatalysis. Prof. Beletskaya is an enthusiast of the Renaissance of Ullmann chemistry, and pays much attention to copper-catalyzed carbon-heteroatom bonds formation, she pay much attention to the catalysis by metal nanoparticles, and in the recent years she focused at photocatalysis and CO₂ utilization trying to bind these two important areas.

In 1974 Prof. Beletskaya was elected a corresponding member of the Academy of Science of USSR, and in 1992 she became a full member of the Russian Academy of Science. Since 1989 Prof. Beletskaya has been head of the Organoelement Chemistry laboratory at the Department of Chemistry of MSU.

Prof. Beletskaya is a Honoured Professor of the Moscow State University, an emeritus academician of the Bashkir National Academy of Science, an emeritus professor of St-Petersburg State University, and Cordoba University (Argentina), Honorary Doctor of Royal Institute of Technology (Stockholm), Professor Honoris Causa of the University of Alicante (Spain), External member of the

Royal Academy of Exact, Physical and Natural Sciences of Spain. She has won the Mendeleev, Lomonosov, Nesmeyanov, Arbuzov and Demidov Prizes for creativity and achievements in chemistry, she was given Markovnikov and Butlerov golden medals, and awarded the State Prize of Russian Federation. Abroad she also won the Kapitza Award Fellowship (UK), and Women in the Engineering Science award (Sweden), National Prize Olympia “Woman of the year”, IUPAC Distinguished Women in Chemistry International Award.

Prof. Beletskaya has been serving for many years as an editor-in-chief of the Russian Journal of Organic Chemistry. She is or has been a member of the editorial boards of a number of leading journals including The Bulletin of Russian Academy of Science, Mendeleev Communications, Organometallics, Chemistry – A European Journal, the Journal of Organometallic Chemistry, Molecules.

For many years Prof. Beletskaya also participated in the activities of the International Union of Pure and Applied Chemistry (IUPAC) serving in late 80s first as a secretary, then a vice-president, and in 1991-1993 as a president of the Division of Organic Chemistry. Until 2001 she was working on the IUPAC Committee on chemical weapons destruction technologies (CWDT).



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