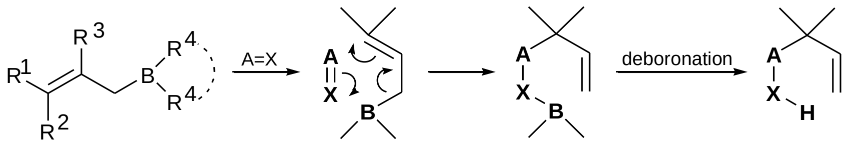
On the anniversary of the full member of the Russian Academy of Sciences Yuri N. Bubnov

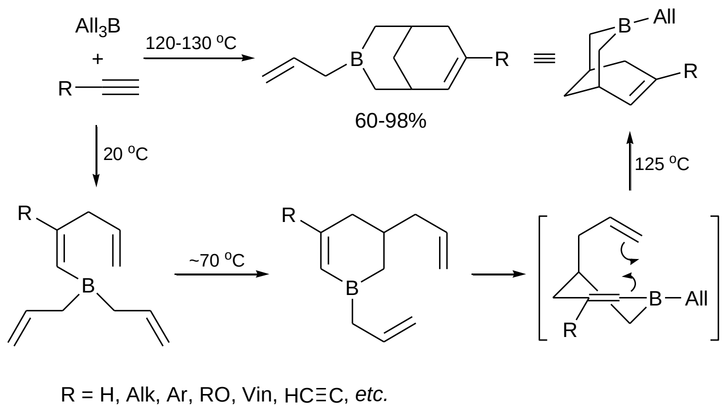
October 1, 2019, marks the 85th anniversary of the full member of the Russian Academy of Sciences, Yuri N. Bubnov, an outstanding scientist, well-known to the world community for his classic works in the field of chemistry of organoboron and heterocyclic compounds.

Yu. N. Bubnov was born in Rostov Veliky, the city in Yaroslavl Oblast, graduated from high school with a silver medal, and entered the Chemistry Department of Lomonosov Moscow State University. After completing his studies in 1957, he was recommended to postgraduate school at the Zelinsky Institute of Organic Chemistry (ZIOC), where he worked under the supervision of B. M. Mikhailov, and defended his PhD thesis in 1961. In 1983 Yu.N. Bubnov successfully defended his DSci thesis, and in 1984 he was elected a head of the Laboratory of Carbocyclic Compounds at ZIOC. In 1994 he was appointed a deputy director of the Nesmeyanov Institute of Organoelement Compounds, and in 1996 he was elected a director of the Institute and held this position until 2013. Yu. N. Bubnov published over 400 scientific papers. He is also an author of several inventions, two monographs [1] and seven book chapters.

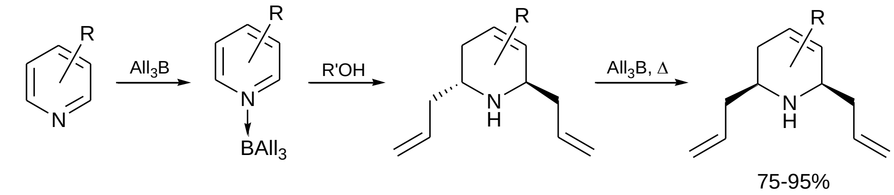
The main directions of the scientific activity of Yu. N. Bubnov throughout his work at the Academy of Sciences are the chemistry of organic boron derivatives, their use in fine organic synthesis and practice. The most important fundamental discoveries of Yu. N. Bubnov and his students are the reactions of allylboration (**Error! Reference source not found.**) [2], allylboron–acetylene condensation (**Error! Reference source not found.**) [3], and reductive mono- and diallylation of nitrogen-containing heteroaromatic systems (Scheme 3) [4]. These are three fundamental processes that form a basis for the design of new unsaturated, cyclic, heterocyclic and framework structures from simple and accessible unsaturated organoboron compounds.



Scheme 1



Scheme 2



Scheme 3

Using these reactions, a general strategy has been developed that serves as a powerful tool in modern synthetic organic chemistry [5]. It opens the way to almost any type of boron compounds from readily available precursors and allows one to synthesize a great variety of organic substances, many of which are difficult or even impossible to obtain by other methods. Among the most significant achievements in this field, of note are the creation and successful use of the drug BG-12, which was obtained based on 1-boraadamantane and exhibited considerable therapeutic and prophylactic effects against poultry flu [6], and a new synthesis of the antiviral drug *rimantadine*, which is widely used in medical practice. Using the "boron methods", including the chiral ones, a number of important natural substances were synthesized (Figure 1.): *muscarine*, *hernandulcin* (three orders of magnitude sweeter than sugar), *grandizol*, *ipsenol*, *ipsdienol*—insect pheromones, pests of crops and forests, and *GABOB*—a neuromodulator of the central nervous system of mammals. In addition, a polymer composite material for orthopedics and dentistry was developed that includes a boron-containing polymerization initiator (in collaboration with Central Institute of Traumatology and Orthopedics, All-Russian Scientific Research Institute of Aviation Materials, and Central Research Institute of Dental and Maxillofacial Surgery).

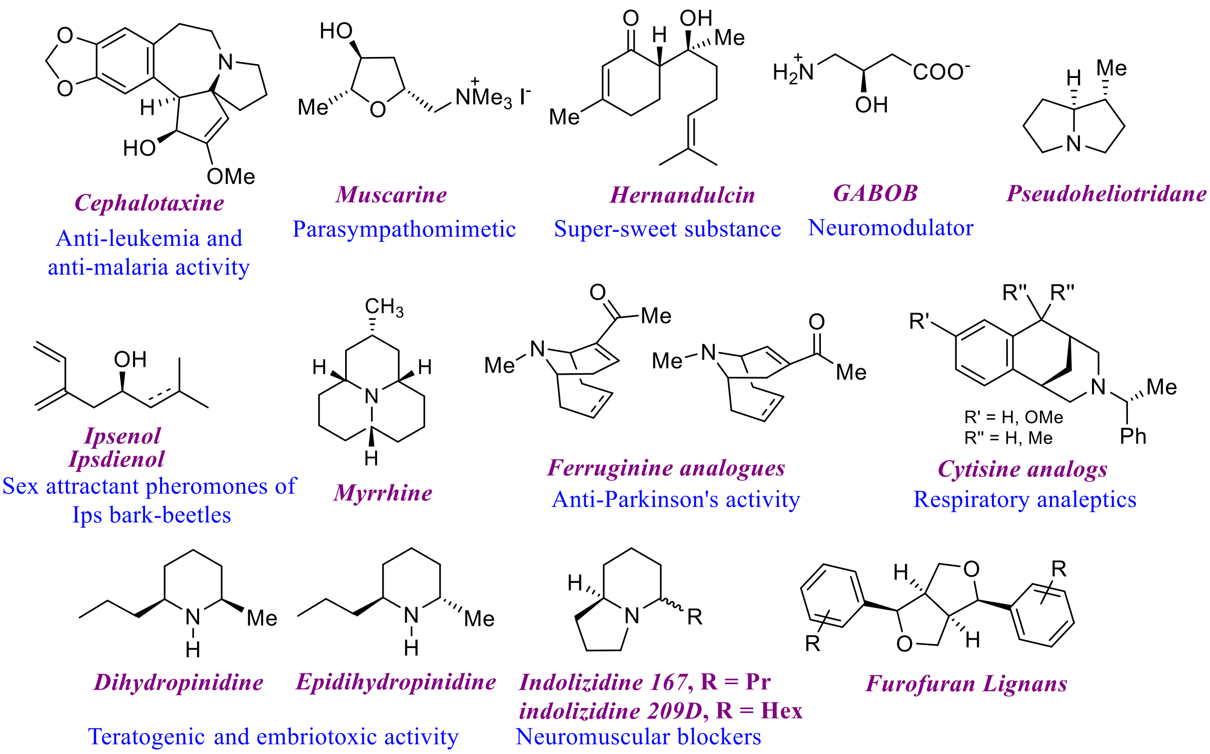


Figure 1. Natural compounds synthesized using boron-containing precursors/intermediates.

The results of paramount importance were obtained studying the effect of organoboranes on highly constrained hydrocarbons and the borotropy and permanent allyl rearrangement in both simple and complex allyl systems. The efficient methods for introducing an isoprene fragment into organic molecules, including its chiral modification, and counter-thermodynamic isomerization of olefins were developed. A peroxide effect in the boron chemistry was discovered. As a result, the scientific classification of the reactions of alkyl- and allylboranes was created that possesses a remarkably predictive character.

In recent years, the attention of Yu. N. Bubnov has been focused on the development of the "boron methodology" in organic and organometallic synthesis, catalytic reactions, structural and conformational analysis. In particular, the first representatives of polyunsaturated organic boron compounds containing π-coordinated transition metals were obtained, a [1,7]-shift of boron was discovered, chiral allylboration and some other asymmetric reactions were studied. New approaches to the construction of bi- and tricyclic systems with tertiary nitrogen atoms were developed, and several important alkaloids and their analogs were synthesized.

Combining the qualities of a talented scientist and an excellent organizer, Yu. N. Bubnov leads his scientific school of organic chemists. In recognition of his scientific merits, Yu. N. Bubnov was elected in 1994 a corresponding member of the Russian Academy of Sciences and in 1996—a full member of RAS. He has received several government awards.

Students, colleagues, and friends sincerely wish Yuri Nikolaevich good health, a long life, family well-being and further creative accomplishments.

References

1. (a) B. M. Mikahilov, Yu. N. Bubnov, *Organoboron Compounds in Organic Synthesis*, Nauka, Moscow, **1977** [in Russian]; (b) B. M. Mikhailov, Yu. N. Bubnov, *Organoboron Compounds in Organic Synthesis*, Harwood Acad. Sci. Publ., London, **1984**.
2. Yu. N. Bubnov, *Vestn. Mosk. Univ., Ser. 2: Khim.*, **2005**, *46*, 140–154.
3. (a) B. M. Mikhailov, Yu. N. Bubnov, *Bull. Acad. Sci. USSR, Div. Chem. Sci.*, **1965**, *14*, 1285. DOI: 10.1007/BF00847925; (b) B. M. Mikhailov, Yu. N. Bubnov, S. I. Frolov, *Bull. Acad. Sci. USSR, Div. Chem. Sci.*, **1967**, *16*, 2193–2199. DOI: 10.1007/BF00913304; (c) M. E. Gurskii, S. Yu. Erdyakov, T. V. Potapova, Yu. N. Bubnov, *Russ. Chem. Bull.*, **2008**, *57*, 802–814. DOI: 10.1007/s11172-008-0119-3
4. Yu. N. Bubnov, E. V. Klimkina, *Chem. Heterocycl. Compd.*, **1999**, *35*, 888–899. DOI: 10.1007/BF02252156
5. (a) N. Yu. Kuznetsov, Yu. N. Bubnov, *Russ. Chem. Rev.*, **2015**, *84*, 758–785. DOI: 10.1070/RCR4478; (b) Yu. N. Bubnov, in: *Science of Synthesis*, **2005**, *6*, 943–1072; (c) Yu. N. Bubnov, *Pure Appl. Chem*., **1987**, *59*, 895–906. DOI: 10.1351/pac198759070895
6. (a) Yu. N. Bubnov, M. E. Gursky, D. G. Pershin, *J. Organomet. Chem.*, **1991**, *412,* 1–8. DOI: 10.1016/0022-328X(91)86035-O; (b) Yu. N. Bubnov, M. E. Gurskii, D. G. Pershin, K. A. Lyssenko, M. Yu. Antipin, *Russ. Chem. Bull.*, **1998**, *47*, 1771–1777. DOI: 10.1007/BF02495703