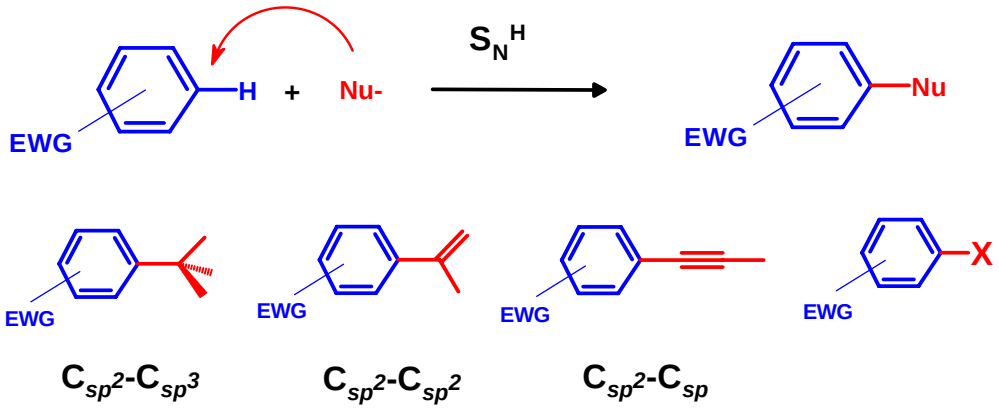
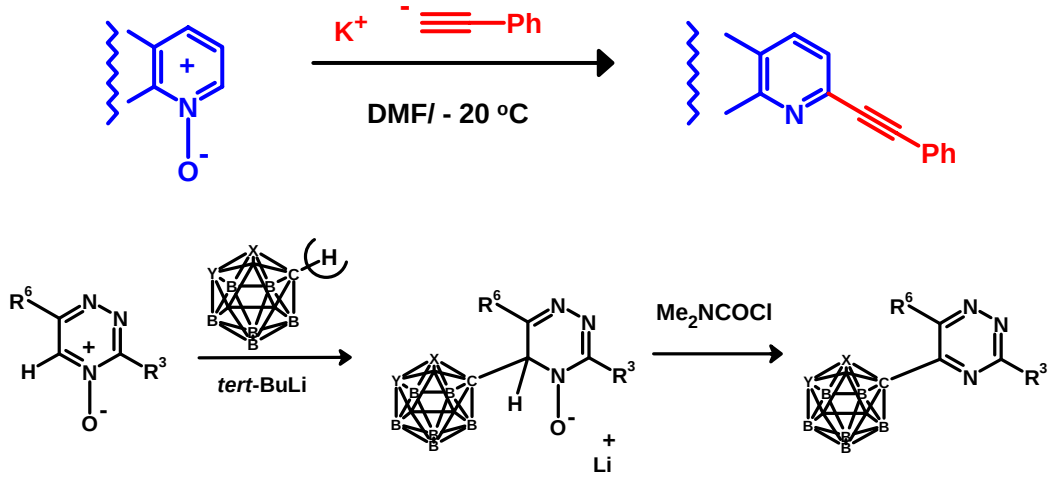
Professor Oleg N. Chupakhin
A Tribute

Oleg N. Chupakhin was born on June 09, 1934. After graduating from the Ural Polytechnical Institute in 1957 he joined the Department of Organic Chemistry of the same University (USTU-UPI). In 1963 he obtained his Ph.D and in 1976 he defended his doctoral thesis "Nucleophilic Substitution of Hydrogen in Azines" which entitled him to become a Full Professor of Chemistry. Since that time he has been head of the Department of Organic Chemistry of USTU. In 1993 he was appointed as Director of the Institute of Organic Synthesis of the Ural Branch of the Russian Academy of Sciences.

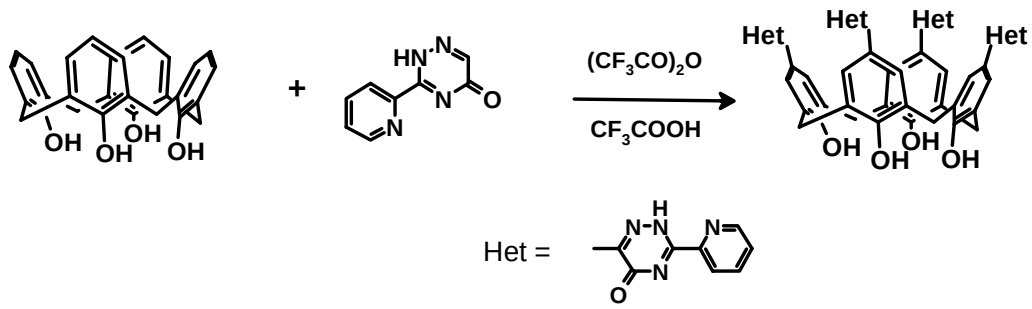
Prof. O. Chupakhin's research interests concern a variety of areas of organic chemistry, but the main part of his research is dedicated to heterocyclic compounds. He became famous through his pioneering work on nucleophilic aromatic substitution of hydrogen in arenes and heteroarenes (S_N^H-process). These studies showed how to use this methodology in organic chemistry, and how to apply it to the synthesis of interesting industrial and medicinal products. He published the first review dedicated to S_N^H reactions[1] and a book that described these transformations.[2]



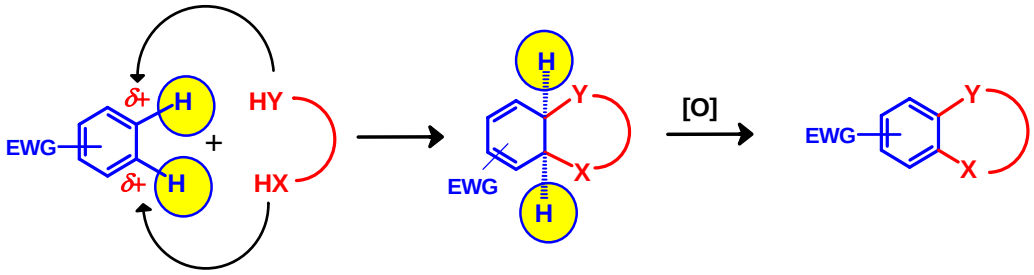
General methods to build new C-Csp^3, C-Csp^2, C-Csp, C-N, C-O, C-P, C-S, C-Hal bonds based on a nucleophilic attack at unsubstituted carbon atom in π-deficient arenes were elaborated under the supervision of Prof. Chupakhin.[3-5] Original synthetic approaches for the construction of a variety of organic compounds were worked out. For example, the S_N^H methodology enables one to replace hydrogen in azaaromatics by reaction with acetylides and all kinds of carbanions.



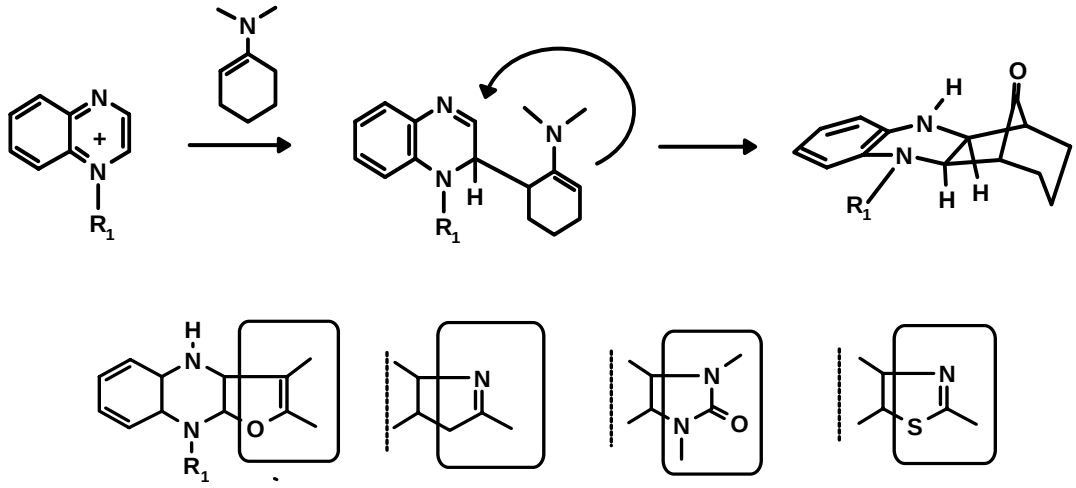
The S_N^H methodology developed by Prof. Chupakhin was also applied successfully in the field of supramolecular chemistry. Direct C-C coupling reactions of azines with such macrocyclic compounds as calixarenes, calixpyrroles, porphyrines, benzo-annelated crown ethers and their analogues were first performed without any metal-containing catalysts. A number of promising heterocyclic compounds with specific receptor ability were obtained which were used for selective extraction, transport of cations and small organic molecules.

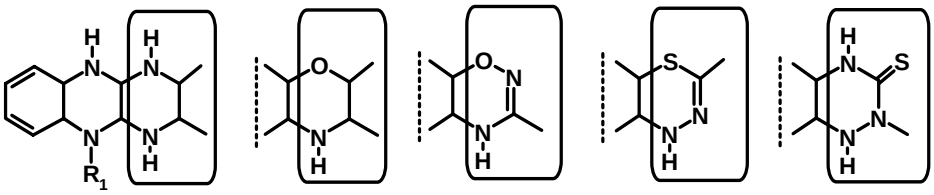


Original synthetic approaches to a variety of novel pyrimidines, pyrazines, 1,2,4-triazines, 1,2,4,5-tetrazines and their annelated derivatives based on nucleophilic substitution of hydrogen or relative processes, such as nucleophilic addition, *tele*- and *cine*-substitutions, A_N-A_N, A_N-S_N^{ipso}, S_N^H-S_N^{ipso}, S_N^H-S_N^H and other types of tandem reactions, were elaborated.[6-19] A common scheme of cyclization based on using the A_N-A_N and S_N^H-S_N^H tandem reactions is given below:

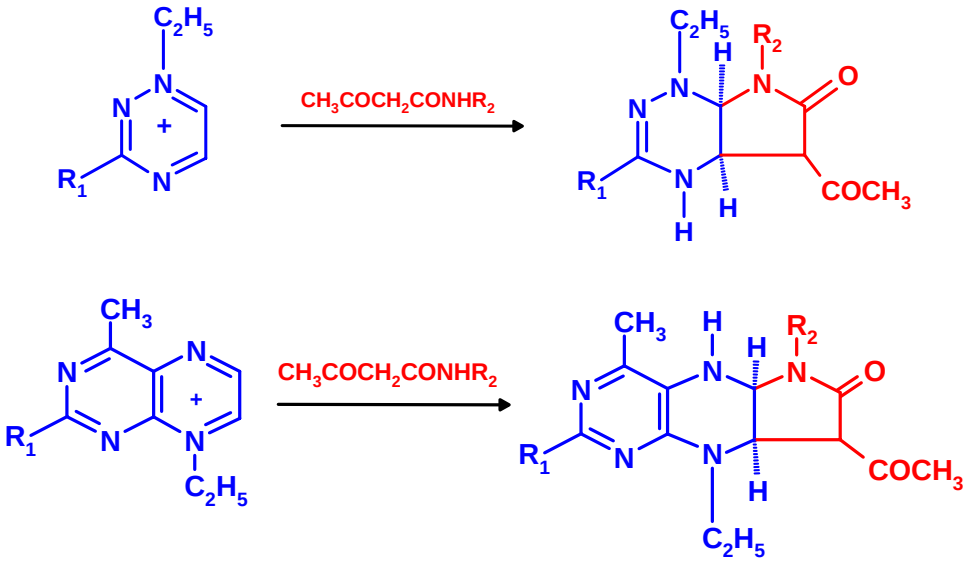


This scheme demonstrates a new approach to the annelation of carbo- and heterocycles, as illustrated by hundred examples for the synthesis of condensed quinoxalines.



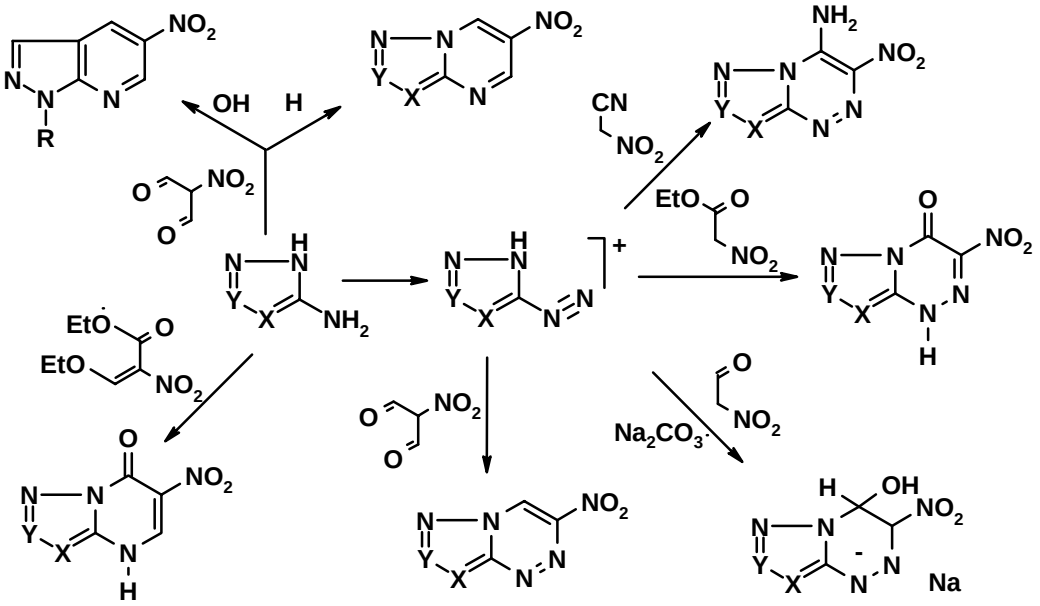


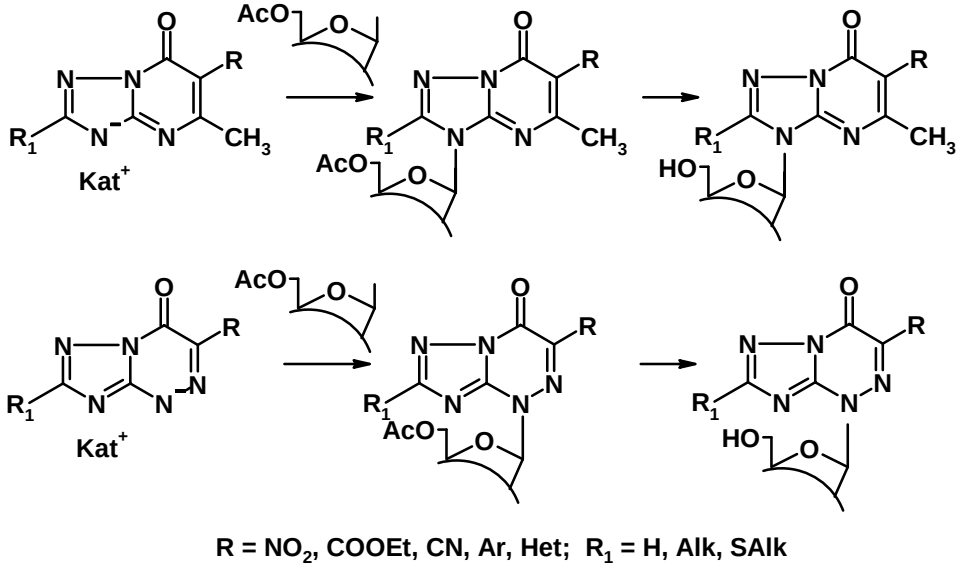
The same methodology can be applied to the chemistry of pyrazines, pyridopyrazines, 1,2,4-triazines, pteridines, as well as their aza- and benzoanalogues.

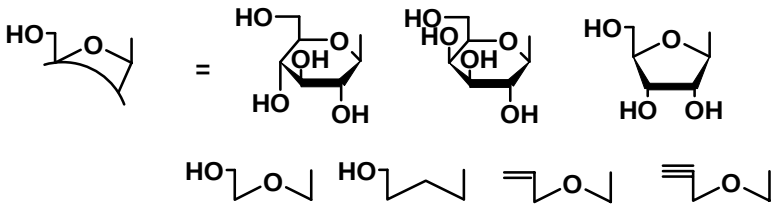


Prof. Chupakhin and his research group developed new approaches to a series of azolo (pyrazolo-, imidazolo-, triazolo-, tetrazolo) annelated azines (pyridines, pyrimidines and 1,2,4-triazines) and abnormal nucleosides.[20]

It was shown that ligands bearing 1,2,4-triazine fragments are of special interest for coordination chemistry. A novel strategy for designing bi- and terpyridyls, appropriate ligands to bind with transuranic elements was developed.[21-23]

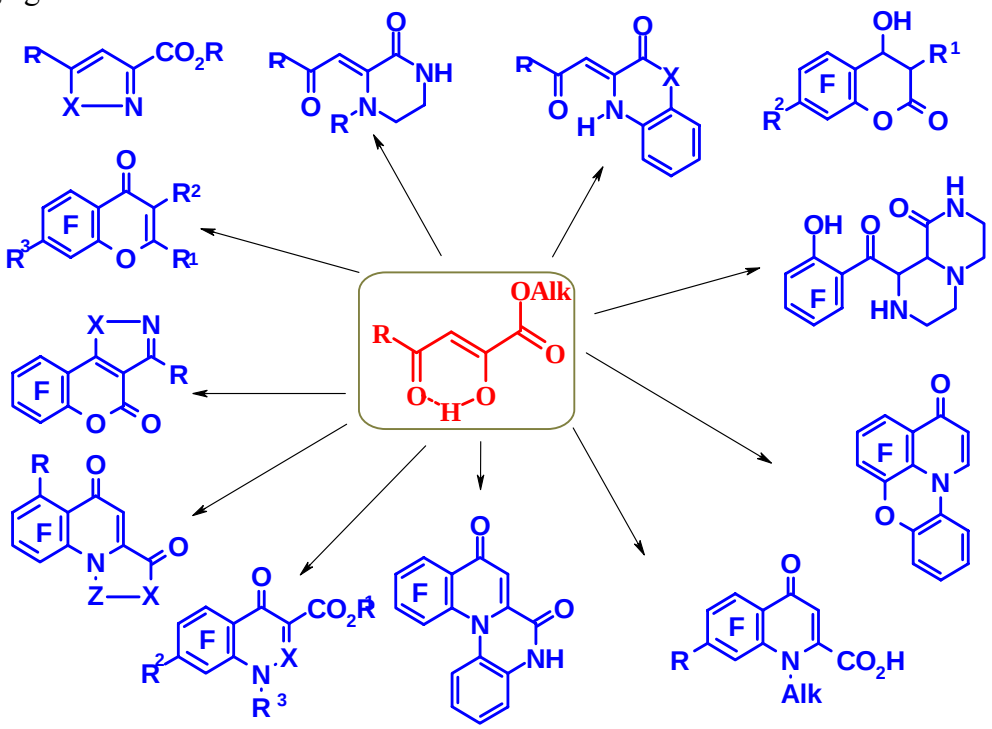




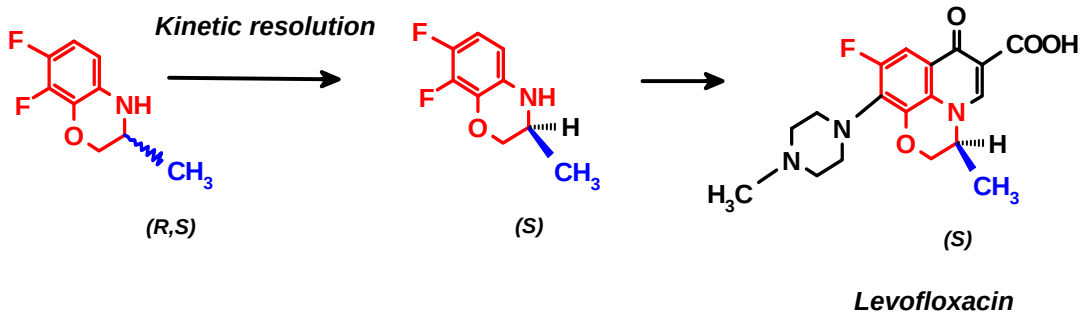


Another area of scientific interest to Prof. Chupakhin is the chemistry of fluorinated compounds. A large series of fluorinated di- and tricarbonyl compounds, α,β-dioxo acids, their ethers, β,β'-triketones, β,β'-dioxoethers, as well fluoroalkyl(aryl)-containing N-, O- and S-

heterocyclic compounds were elaborated at the Institute of Organic Synthesis, including biologically active compounds, catalysts for polymerization reactions, analytical reagents, extracting agents and others.[24-26]



The targeted synthesis of the whole family of fluoroquinolones and other DNA-gyrase inhibitors was achieved. An original method for the synthesis of enantiomeric (*S*)-7,8-difluoro-3-methyl-2,3-dihydro-4H-[1,4]benzoxazine and (*S*)-9,10-difluoro-3-methyl-7-oxo-2,3-dihydro-4H-1,4-oxazin[6,5,4-*i*,*j*]quinaline-5-carboxylic acid (the key intermediates for the synthesis of *levofloxacin* the well-known drug of the fluoroquinolone family) was elaborated. It is based on *kinetic resolution* of enantiomers by action of chiral agents.[27-29]



Clinical trials of a new antitumor drug “Lizomustin” developed in the Institute of Organic Synthesis have revealed its high potency towards malignant melanoma and lymphosarcoma and lung cancer. The drug has been registered in Russia (V.P. Krasnov, G.L. Levit, O.N. Chupakhin) and recommended for large-scale production.

Prof. Oleg Chupakhin has published over 550 papers, 11 monographs and 100 patents.

As a distinguished scientist he is a member of the International Heterocyclic Society, the Russian National Committee of Chemists, the International Union of Antiviral Compounds and a member of the editorial broads of the *Russian Journal of Organic Chemistry*, and the *Russian Journal on Chemical Physic*s. He is a very active participant of many international conferences. Just to mention a few recent events: the XXVIII International Symposium on Macrocyclic Chemistry (Gdansk, Poland, 2003), XVII Mendeleev Congress on General and Applied Chemistry (Kazan, Russia, 2003), XIII European Symposium on Organic Chemistry (Dubrovnik, Croatia, 2003), the First World Congress on Synthetic Receptors (Lisbon, Portugal, 2003). He has been invited as a guest professor to Universities of Darmstadt, and Warsaw.

Prof. Chupakhin is a Full Member of the Russian Academy of Sciences. He has been awarded the Order of Friendship (1999) by the Russian Government with the Prize of the Council of Ministers of USSR Prize (1990) and the Order of Hohour (2003).

Oleg Chupakhin is always an open, cordial and friendly personality. He is very sensitive, can listen and is ready to help, not only in relation to scientific work. Professor Chupakhin is an excellent supervisor and many of his former students and post-graduates (over 50 Ph.D students and 7 professors) have achieved success in academic life. We sincerely thank him for his continuous efforts over many years and congratulate him on his 70th birthday. It has been a great honour and pleasure for us to write this tribute. We wish him further success in his scientific work. May he enjoy good health in the years ahead, together with his wife and family.

Professors Valery N. Charushin, Victor I. Saloutin and Henk C. van der Plas

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