## Abstract in English

**Fluorinated pyrazoles** are an extremely useful structural motif in many industries, particularly in medicine and agrochemistry. Despite the intense interest in these compounds over the past 45 years, the search for new, simple, and efficient methods for their synthesis remains important. The most significant methods for obtaining fluorinated pyrazoles include condensation reactions, acid-induced intramolecular cyclizations, functionalisation of the pyrazole ring with fluoroalkyl groups, and cycloaddition reactions. I am developing my research interests by exploring the chemistry of **fluorinated nitrile imines** as useful and readily available building blocks.

In this dissertation, I used the 1,3-dipolar character of nitrile imines in (3+3) annulation reactions with **α-mercaptoacetaldehyde**, as a safe substitute for acetylene, to obtain the expected 1-arylpyrazoles. This opened the way for further functionalisation of the title compounds at the C(4) and C(5) positions of the heterocyclic ring, which in turn enabled the synthesis of a series of derivatives with potential applications in medicine.

The first of these topics involved the annulation of α-mercaptoacetaldehyde and the *in situ*-generated nitrile imines, leading to 5,6-dihydro-5-hydroxy-4*H*-1,3,4-thiadiazines, which readily undergo dehydration and subsequent spontaneous ring contraction. I obtained the corresponding **4,5-unsubstituted pyrazoles** in the **one-pot** method. I also investigated the influence of the electronic properties of the substituents on the studied reaction. It is worth note that the developed method is also effective for non-fluorinated nitrile imines, despite significantly different electronic parameters.

The next stage of the work carried out as part of this thesis involved the **selective functionalization** of pyrazole at the C(4) and C(5) positions. To this end, I developed a method utilising molecular iodine in a CAN-induced reaction, yielding products functionalized at the C(4) position of the pyrazole ring, whilst access to the isomeric 5-iodo derivatives was achieved by exploiting the increased acidity of the hydrogen atom at the C(5) position, as a result of the *in situ* generation of the corresponding pyrazol-5-yl anion and its subsequent capture by molecular iodine. The resulting iodides exhibited the expected reactivity in **Sonogashira and Suzuki-Miyaura couplings** regardless of the position of substitution. The protocol proved to be effective for the preparation of selected bioactive compounds from the coxib group (Mawacoxib, Celecoxib and SC-560).

The final research area included the development of an innovative approach to the synthesis of $CF_3$-pyrazoles functionalized with an azide group at the C(5) position. Their subsequent use in **copper-catalysed azide-alkyne cycloaddition** (CuAAC) opened up the synthesis of pyrazole-triazole hybrids. To confirm their high application potential, I tested a wide range of alkyl and (het)aryl acetylenes, and demonstrated the exceptional stability of these products under harsh oxidative and reductive conditions, which enabled the efficient conversion of functional groups.