# ANNOTATION

The research in this Ph.D. thesis deals with the preparation of new substitutional derivatives of cobaltabisdicarbollide and icosahedral carboranes designed primarily to search for new drugs to inhibit the HIV-1 protease enzyme, which causes AIDS. The use of borane clusters overcomes the shortcomings of existing organic inhibitors. After synthesis of the compounds reported here, they were passed to biochemists who measured the inhibition kinetics of these substances on an isolated enzyme HIV-1 protease ($IC_{50}$), and performed similar tests on HIV-1 infected cell cultures ($EC_{50}$). For each compound, the concentration which caused an inhibition of enzyme activity (substrate cleavage) of 50 % of the concentrations of, $IC_{50}$ (*in vitro*) and $EC_{50}$ (*in vivo*) were included into boron compounds library. Additionally included was the specific mechanism by which the substances were able to selectively inhibit the enzyme. These findings are a key to possible future drug substructure determination. The author of this thesis synthesized and characterized a series of fourteen new compounds containing a motif of two units of cobalt bisdicarbollide connected with a flexible organic chain via a functional group embedded in the center of the molecule. Twelve new B-N derivatives offering cobalta bisdicarbollide nitrile, amino, amido and amidine functional groups were also prepared. These can serve as new building blocks in organic synthesis, suitable for the incorporation of these types of substances in materials and thereby introducing many unique features. All the newly prepared compounds were characterized using advanced instrumental methods of structural research, i.e. NMR, HPLC-ESI MS and X-ray analysis.