Abstract

The approach presented in this dissertation involves creating a direct linkage through a covalent bond between the macrocycle at its *meso* position and a desired atom of an α-amino acid (*N*- terminal or side chain). Thus created porphyrin–amino acid hybrids are distinguished by their properties directly derived from the character of the *meso* substituent and its capability to interact with the macrocycle π cloud. The library of conjugates includes 6 N^{α}-arylated non-polar amino acid methyl esters, 7 phenylalanine derivatives with a *meso*-aminoporphyrin substituent in the side chain, including 2 fused compounds, and 5 tryptophan derivatives, 3 of which contain a unique 2,3-dihydroazocine linker.

An application of oxidative amination of a porphyrin with substituted anilines for one-step formation of fused structures as a result of cascade C(*meso*)–N, C(β)–C(*ortho*) bond formation is particularly interesting, as it remains the only one-step method to access such compounds. Moreover, an extension of this oxitavie C–Y (Y = N, O, S) coupling method to C–C coupling of porphyrin and indole rings was presented. In the case of tryptophan, a cascade C(*meso*)–C(3), C(β)–N(α) bond formation was observed, leading to formation of a 2,3-dihydroazocine ring as a linker between the macrocycle and the indole ring. The structural features generated through annelation render these derivatives suitable as receptors for molecular recognition of amino acid esters.

Selected porphyrin–amino acid conjugates were applied in the synthesis of oligopeptides with predefined sequence and α-helical secondary structure. Precise design of the peptide linker enabled inter-chromophore electronic communication and its application as molecular tweezers in molecular recognition of a wide range of bidentate substrates.