# Molecular Dynamic Staircases: All-Carbon Axial Chiral "Geländer" Structures

Rajesh Mannancherry, Michel Rickhaus, Daniel Häussinger,
Alessandro Prescimone, Marcel Mayor

University of Basel, Department of Chemistry, Basel, Switzerland
E-mail: raj.mannancherry@unibas.ch

Molecules with helical structure have fascinated chemists for many years. Spiral staircases, propellers and screws are representative examples of helical structures that have attracted the attention of designers, architects and researchers. Chiral polycyclic aromatic compounds (PACs) have been of particular interest to fundamental researchers and material scientists since the concept of molecular chemistry was born. Chiral PACs have gained strong interest from both chemists and physicists due to their structural beauty, stability and exceptional optical and electronic properties for material applications. Recently, our group succeeded in synthesising a novel type of Geländer molecule with a terphenyl backbone and a banister oligomer.[1-2]

Motivated by these previously achieved results, we present a new synthetic strategy to the all-carbon polycyclic ladder systems **1** and **2** (Figure 1).[3] The elimination of the chalcogen atoms yielded a more tightly-packed Geländer oligomer with a less flexible ethyl bridge. Two thermodynamically more stable macrocycles were obtained and the crystal structures of both constitutional isomers were obtained. The optical properties and the thermodynamic parameters of both structures have been studied by dynamic CD and HPLC analysis.

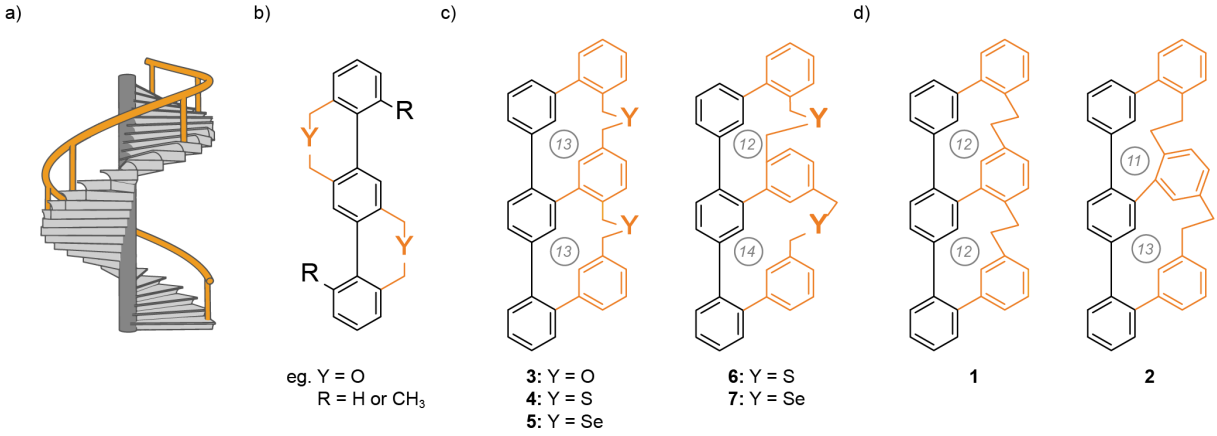


Figure 1: a) Concept of a helical staircase with a banister (orange). b) Vögtle's first terphenylene Geländer oligomer design.[4] c) Schematic illustration of the achieved Geländer molecules **3**-**7** with different heteroatoms in the bridging unit.[1-2] d) Schematic illustration of the all-carbon Geländer macrocycle **1** and **2**.[3] The circled numbers correspond to the number of atoms in each macrocycle.

[1] M. Rickhaus, L. M. Bannwart, M. Neuburger, H. Gsellinger, K. Zimmermann, D. Häussinger, M. Mayor, *Angew. Chem. Int. Ed.*, **2014**, *53*, 14587-14591.
[2] M. Rickhaus, O. Unke, R. Mannancherry, L. M. Bannwart, M. Neuburger, D. Häussinger, M. Mayor, *Chem. Eur. J.*, **2015**, *21*, 18156-18167.
[3] R. Mannancherry, M. Rickhaus, D. Häussinger, A. Prescimone, M. Mayor, *Chem. Sci.*, **2018**, *9*, 5758-5766.
[4] B. Kiupel, C. Niederalt, M. Nieger, S. Grimme, F. Vögtle, *Angew. Chem. Int. Ed.*, **1998**, *37*, 3031-3034.