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These self-organized non-covalent lanthanide podates offer fascinating possibilities for the molecular and supramolecular programmation of structural and electronic properties in Ln^{III} devices. They are currently investigated as prototypes for *i*) selective recognition of Ln^{III}, *ii*) directional vis → vis light conversion, *iii*) coupled optical-magnetic switches, and *iv*) luminescent metallomesogens.

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Towards the Synthesis of Functionalized Ribonucleic Acids

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Stefan Pitsch*

Current Research Topics

Being fascinated by the structure and the biological function of nucleic acids, I would like to contribute to their research. As a synthetic chemist, I am planning to investigate the synthesis, properties, and potential applications of functionalized oligonucleotides. Thereby, I am concentrating on the (so far) less intensely investigated ribonucleic acid (RNA). About one year ago, I started developing a strategy for the synthesis of C(5')-functionalized nucleoside building blocks and RNA oligonucleotides derived therefrom, and have chosen (unnatural) L-configurated RNA as a first

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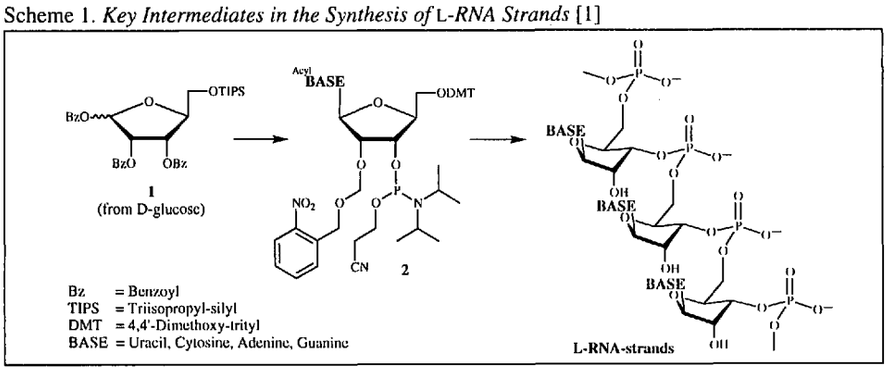
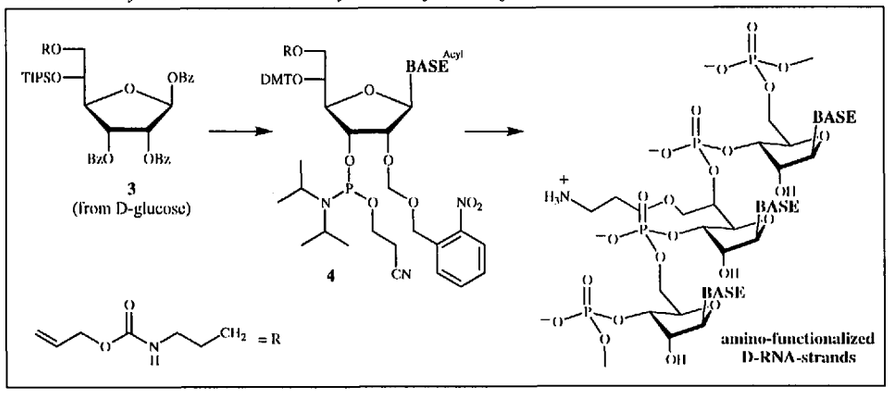
Scheme 1. *Key Intermediates in the Synthesis of* L-*RNA Strands* [1]



Scheme 2. *Key Intermediates in the Synthesis of Amino-functionalized* D-*RNA Strands* [2]



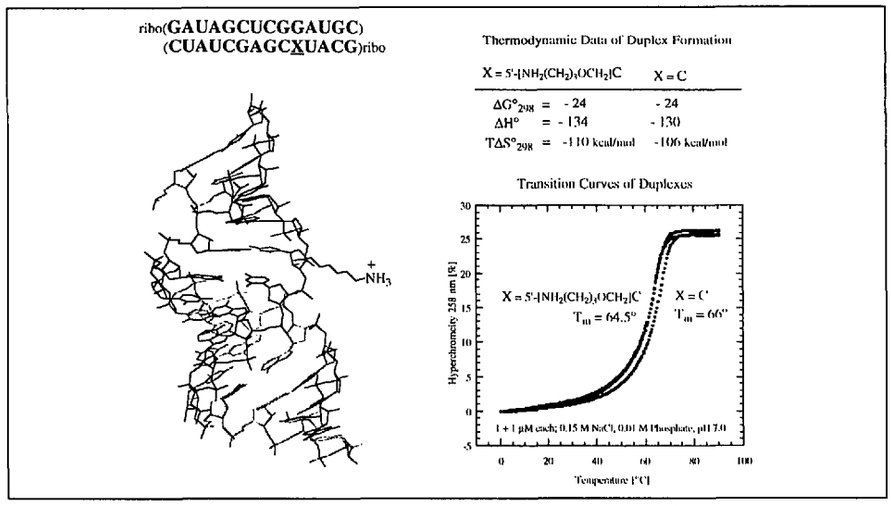


Figure. *Model representation of an RNA duplex in the A-form, containing a 1-[6'-*O*-(ω-aminopropyl)-β-*D*-allofuranosyl]cytosine nucleoside* (left), *and comparison of thermodynamic data of duplex formation* [5] *and transition curves* ('melting curves') *between an amino-functionalized RNA tetradecamer and the parent oligonucleotide* (conditions: 0.15M NaCl, 0.01M phosphate, pH = 7) (right)

model system (*Scheme 1*) [1]. Based on these studies, and together with a Ph.D. student who started her dissertation in September 1996, it was meanwhile possible to efficiently synthesize and incorporate a 6'-*O*-aminopropyl-β-D-allofuranosyl-nucleoside building block into an RNA strand and to determine the pairing properties of this functionalized oligonucleotide (*Scheme 2*) [2].

Within the first project, a facile synthesis of the prefunctionalized L-ribose derivative **1** from D-glucose was developed (*Scheme 1*). This common intermediate was converted in a few, simple steps to the phosphoramidite building blocks **3** containing the four canonical nucleobases. For the protection of the positions O–C(2'), the known photocleavable (*ortho*-nitrobenzyloxy)methyl group [3] was chosen, and reaction conditions were developed to introduce this group regioselectively. From these building blocks, RNA oligonucleotides were efficiently synthesized on a DNA synthesizer. Complete deprotection of the L-RNA strands was achieved by ammonolysis followed by photolysis applying improved reaction conditions developed within this project.

L-RNA, besides being the product from a model study, is no substrate for the ubiquitous RNA-cleaving enzymes and is hence a superior material for all investigations where no enzymes, cells, or organisms are involved, such as physicochemical or structural studies. In collaboration with Dr. *Martin Egli* (Northwestern Medical School, Chicago) the (potentially superior) properties of racemic, homochiral RNA oligonucleotides with respect to crystallization behavior and structure determination will be studied.

Following exactly the same route as described above, we have meanwhile synthesized the phosphoramidite building block **4** derived from D-allofuranose, carrying an allyloxycarbonyl-protected aminopropyl group at O–C(6') (*Scheme 2*). This compound was incorporated into RNA oligonucleotides with comparable efficiency to the unmodified nucleoside. The orthogonality of the protecting groups allowed a selective liberation of the amino group, with the oligonucleotide still attached to the solid support [4].

The determination of the pairing properties and CD-spectroscopical data of RNA tetradecamer derivatives revealed that the base pairing and the conformation of an RNA A-type duplex is not disturbed severely by the introduction of an aminoalkyl-substituted D-allofuranosyl nucleoside (*Figure*). We are currently developing reaction conditions for the formation of conjugates and the introduction of other functional groups into such prefunctionalized nucleic-acid structures.

I am very grateful for the generous support from the '*Alfred-Werner*-Stiftung', which is offering me the unique opportunity to spend all the time, now and in the coming years, on my research projects [6].

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[6] I would like to express my gratitude to Prof. *A. Vasella* for supporting me so generously. Additional financial support from the ETH-Zürich is greatly acknowledged.