participate in hydrogen-bonded networks as neutral, mono-, and diprotonated species, but also because the conformational freedom allows optimum orientation in space of the functional groups. The acid–base reaction allows a conception for the preparation of a great variety of hydrogen-bonded organometallic crystalline compounds in which metal atoms in different oxidation and spin states can be combined within robust hydrogen-bonded superstructures. Furthermore, the abundance of polarized C–H groups on metal-coordinated ligands, such as C_5H_5 and C_6H_6, make the use of C-H···O hydrogen bonds also profitable, in particular since they may be reinforced when hydrogen donors and acceptors belong to cations and anions, respectively.[6]

Experimental Section

$FeACH_2$ (84 mg, 0.3 mmol) was dissolved in anhydrous THF (20 mL), and $(\eta^5\text{-}C_5H_5)_2Co$ (57 mg, 0.3 mmol) was added. $FeACH_2$ (71 mg, 0.26 mmol) was dissolved in anhydrous THF (16 mL), and $(\eta^6\text{-}c_6H_6)_2Cr$ (54 mg, 0.26 mmol) was added. The oxidation of cobaltocene and bis-benzene chromium was almost instantaneous. In both cases an orange precipitate was formed. After 1 h the slurries were filtered, and the orange powders were recrystallized from nitromethane to afford air-stable orange crystals of **1** and **2**.[8] $(\eta^5\text{-}c_5H_5)_2Co$ (57 mg, 0.3 mmol) was dissolved in water (20 mL) and stirred until complete oxidation to yellow $[(\eta^5\text{-}c_5H_5)_2Co][OH]$ had occurred. $FeACH_2$ (8 mg, 0.03 mmol) was added to an aliquot (5 mL) of the solution and stirred for 15 min. The yellow-orange solution was filtered and evaporated to dryness, and the resulting solid was recrystallized from nitromethane to afford well-formed crystals of **3**.[8]

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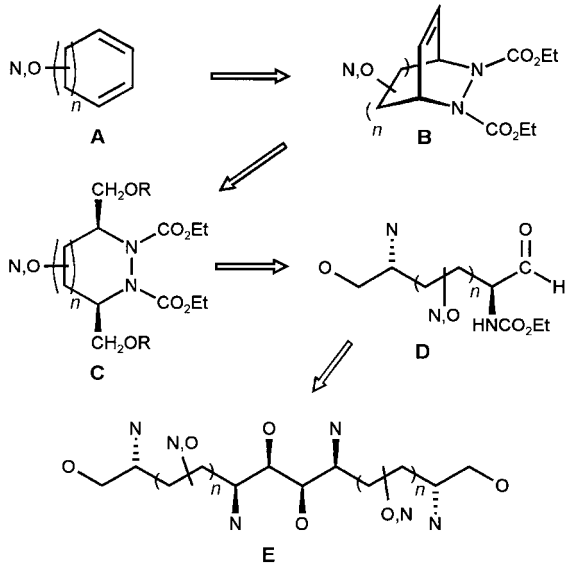
[1] a) D. Braga, F. Grepioni, *Chem. Commun*. **1996**, 571; b) D. Braga, F. Grepioni, G. R. Desiraju, *Chem. Rev.*, **1998**, *98*, 1375.
[2] G. R. Desiraju, *Angew. Chem.* **1995**, *107*, 2541; *Angew. Chem. Int. Ed. Engl.* **1995**, *34*, 2311.
[3] See, for example, a) C. Elschenbroich, O. Schiemann, O. Burghaus, K. Harms, *J. Am. Chem. Soc*. **1997**, *119*, 7452; b) D. Braga, F. Grepioni, D. Walther, K. Heubach, A. Schmidt, W. Imhof, H. Görls, T. Klettke, *Organometallics* **1997**, *16*, 4910; c) P. J. Davies, N. Veldman, D. M. Grove, A. L. Spek, B. T. G. Lutz, G. van Koten, *Angew. Chem.* **1996**, *108*, 2078; *Angew. Chem. Int. Ed. Engl.* **1996**, *35*, 1959.
[4] F. Takusagawa, T. F. Koetzle, *Acta Cryst.* **1979**, *B35*, 2888.
[5] a) D. Braga, F. Grepioni, J. J. Byrne, A. Wolf, *J. Chem. Soc. Chem. Commun*. **1995**, 1023; b) D. Braga, A. L. Costa, F. Grepioni, L. Scaccianoce, E. Tagliavini, *Organometallics* **1997**, *16*, 2070.
[6] Hydrogen atoms bound to oxygen atoms in crystalline **1** and **2** were observed in the Fourier maps. To evaluate the C-H···O bonds, the C–H distances were normalized to the neutron derived value of 1.08 Å and the program PLATON was used: A. L. Spek, *Acta Crystallogr. Sect. A* **1990**, *46*, C31.
[7] a) D. Braga, F. Grepioni, F. *Acc. Chem. Res.* **1997**, *30*, 81; b) D. Braga, G. Cojazzi, F. Grepioni, N. Scully, S. M. Draper, *Organometallics* **1998**, *17*, 296.
[8] Crystallographic data (excluding structure factors) for the structures reported in this paper have been deposited with the Cambridge Crystallographic Data Centre as supplementary publication no. 101304. Copies of the data can be obtained free of charge on application to CCDC, 12 Union Road, Cambridge CB2 1EZ, UK (fax: (+44) 1223-336-033; e-mail: deposit@ccdc.cam.ac.uk).

From Cycloolefins to Linear C_2-Symmetrical 1,4-Diamino-2,3-diol Building Blocks—Peptide Mimetics, Biocatalysis, and Pinacol Coupling of α-Amino Aldehydes**

Joachim Armbruster, Stefan Grabowski, Thomas Ruch, and Horst Prinzbach*

C_2-Symmetrical l,4-diamino-2,3-diol units of type **E** are central structural elements in numerous bioactive compounds.[1] A variable synthesis of such building blocks, based on the recently reported route to enantiomerically pure amino aldehydes of type **D** from technical cycloolefins **A**,[2] and



exemplary applications of this synthetic concept in the area of important bioactive compounds are the subjects of this communication.[1, 3]

The linear, enantiomerically pure C_8 amino aldehyde (+)-**4** (**D**, $n=2$) is prepared by the reaction sequence depicted in Scheme 1:[2] addition of diethyl azodicarboxylate (DEAD) to l,3-cyclooctadiene (**l**), ozonolysis, reduction (strictly following a temperature program), and enzymatic asymmetrization, either by esterification of the *meso*-diethyl 3,8-bis(hydroxymethyl)-l,2-diazacyclooctane-l,2-dicarboxylate (**2a**) (→(+)-**2c**) or hydrolysis of the diacetate **2b** (→(−)-**2c**); lipozyme IM

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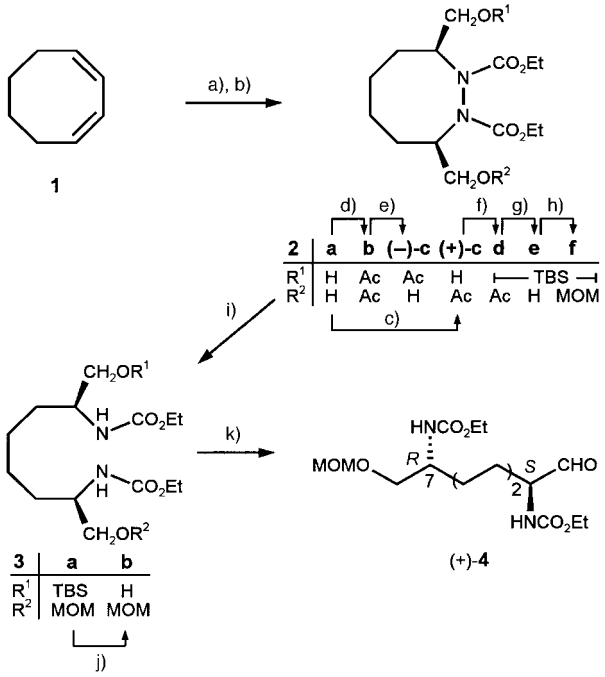
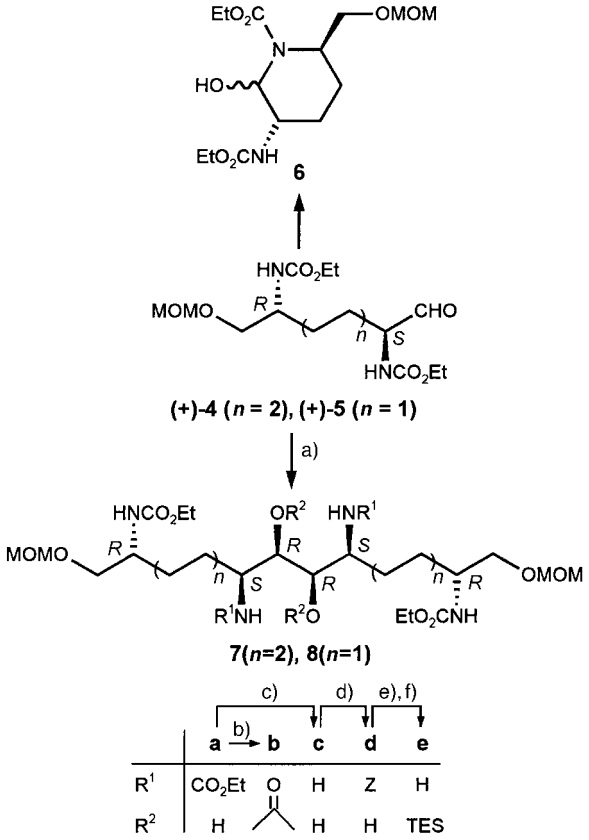


Scheme 1. a) DEAD, *hv*, 5 d, 87%; b) O_3, EtOH, −48 °C, then $NaBH_4$, −48 °C, 10 min, room temperature (RT), quenching with acetic acid at −48 °C, 92%; c) lipozyme IM, vinyl acetate, RT, 4 d, 78%, *ee* > 95%; d) Ac_2O, pyridine, DMAP, RT, 12 h, 98%; e) lipozyme IM, phosphate buffer (0.2 N; pH 6.8), *n*-hexane, RT, 8 d, 69%, *ee* = 93%; f) TBSCl, imidazole, DMF, RT, 96%; g) NH_3/MeOH, 0 °C, 4 d, 98%; h) MOMCl, *i*Pr_2NEt, 0 °C, 1 d, 91%; i) Li/NH_3, −78 °C, 1 h, 93%; j) TBAF, THF, RT, 2 h, 98%; k) oxalyl chloride, DMSO, −78 °C, NEt_3, 1 h, quenching with citrate buffer (pH 3.3) at −15 °C, 96%. DEAD = diethyl azodicarboxylate, DMAP = 4-dimethylaminopyridine, TBS = *tert*-butyldimethylsilyl, MOM = methoxymethyl, TBAF = tetrabutylammonium fluoride, DMSO = dimethyl sulfoxide.

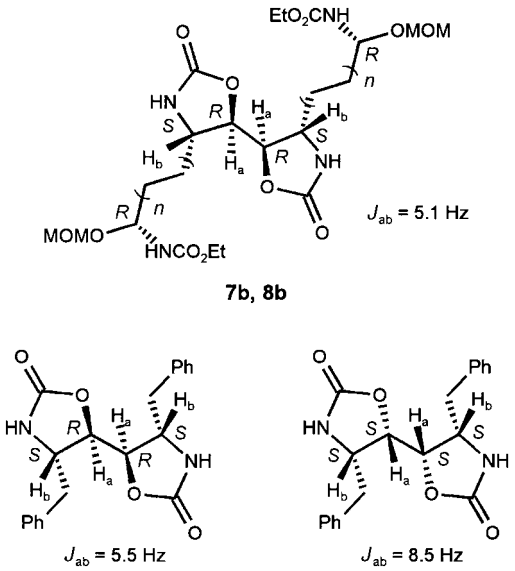


Scheme 2. a) With (+)-**4**: 0.27 equiv of $[V_2Cl_3(thf)_6]_2[Zn_2Cl_6]$, CH_2Cl_2, degassed, anhydrous, N_2 atmosphere, RT, 2 h, then 0.5 M citrate buffer (pH 4.7), > 90% mixture of diastereomers (> 80% **7a**); with (+)-**5**: a) 1.0 equiv of $[V_2Cl_3(thf)_6]_2[Zn_2Cl_6]$, CH_2Cl_2, RT, 4 h, then 0.5 M citrate buffer (pH 3.3), 60% mixture of diastereomers (80% **8a**), 26% **6**; b) 0.18 M NaOH in dioxane/water (1/1), RT 2 h, 99%; c) 0.18 M NaOH in dioxane/water(1/1), 80 °C, 12 h; d) ZCl, *t*BuOH, $NaHCO_3$, H_2O, RT, 15 min, 78% (based on **7a**); e) TESCl, imidazole, DMF, RT, 3 h; f) H_2, Pd/C (5%), toluene, 4 h, 92% (based on **7d**). Z = benzyloxycarbonyl, TES = triethylsilyl.

proved to be the enzyme of choice for both alternatives (70–80% yield each, *ee* ≥ 93%). Manipulation of the protecting groups (so far only practiced with (+)-**2c** to give **2f**), reductive N–N cleavage (**3a**) as well as the final Swern oxidation **3b** → (+)-**4** (the absolute configuration 2*S*,7*R* is preliminary[2]) proceeded with very high yield; under the specified conditions the optical purity is not affected.[1c, 4] In crystalline form (+)-**4** can be kept in stock, whereas in solution ($CHCl_3$) epimerization at C-2 occurs slowly.

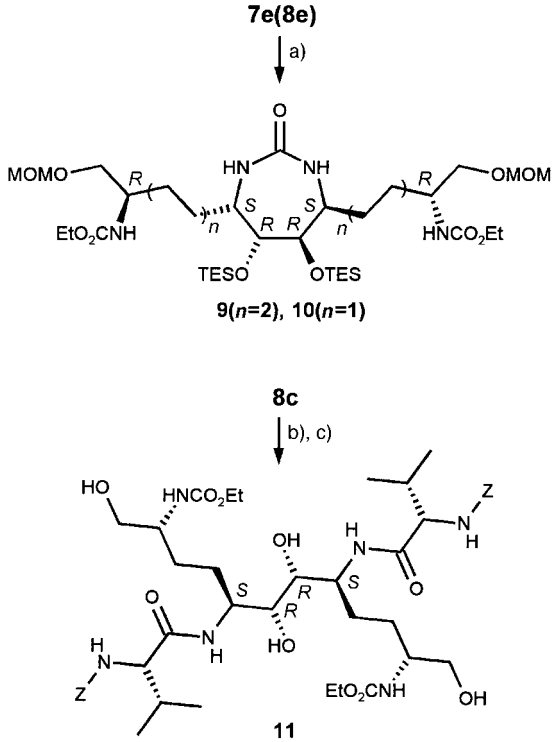
With aldehyde (+)-**4** and the C_6 homologue (+)-**5**[2] the prospect for stereoselective pinacol coupling was checked by making use of several one-electron reductants (e.g. SmI_2[5] and $C_{l6}Mg$[6]).[7] Caulton's reagent ($[V_2Cl_3(thf)_6][Zn_2Cl_6]$)[8] provided the best—for (+)-**4** and (+)-**5**, however, significantly differing—results so far (Scheme 2): In the case of (+)-**4** 0.27 equiv of reagent (ca. 1 equiv of V^{2+}) was sufficient to bring about total conversion. After appropriate workup (addition of the reaction mixture to 0.5 M citrate buffer, pH 4.7), the isolated mixture of dimers (> 90%) consisted mainly of **7a**; the yield of pure **7a** (> 80%) collected after crystallization from ethanol compares well with literature reports.[1c, 4, 9] One of the two side products (ca. 5% each, "dimers" according to mass spectrometry) was identified as a O-MOM-cleaved derivative of **7a**; for the second a reliable assignment is not yet possible (*S,S,S,S* dimer?). For total conversion of (+)-**5** a significant excess of reagent is needed (1.0 equiv, that means 4 equiv of V^{2+}). The outcome of the reaction is insofar much more complex, as besides dimerization to give **8a** (ca. 45% in addition to ca. 10% of diastereomers) O-MOM cleavage (12%) and cyclization to the azasugar **6** (up to 26%) cannot be avoided (no hint of the *S,S,S,S* dimer). The amount of reagent necessary presumably reflects the complexations induced by the given functionalization pattern and responsible for the competing reaction channels.[4, 8] The *S,R,R,S* configuration assigned to **7a** and **8a** is based on a comparison of the bisoxazolidinones **7b** and **8b**, synthesized from **7a** and **8a** under base catalysis, with the bisoxazolidinones pictured in Scheme 3, whose absolute configurations of *S,R,R,S* and *S,S,S,S* have been established,[10] and on the evaluation of the diastereomeric transition states of the dimerization pathways (Pederson[8]).

From **7a** and **8a**—examples for potential libraries of structurally varied derivatives—the cyclic ureas **9** and **10** as well as the pseudotetrapeptide **11** are prepared (Scheme 4); they are potential peptide mimetics (see, for example, the structurally related protease inhibitor models DMP 323[1a] and



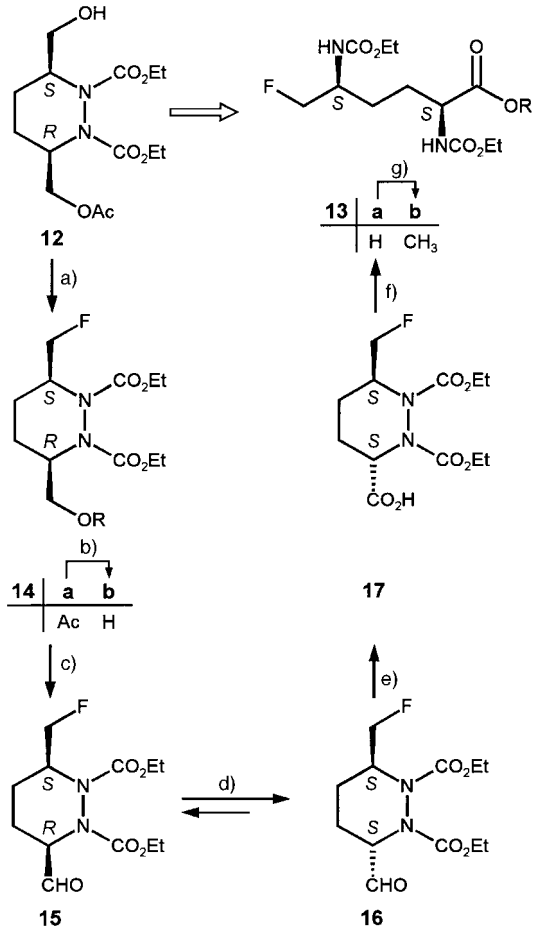
Scheme 3. The assignment of the absolute configuration of **7b** and **8b**.

A 77003[1b]). It was essential for the efficiency of these syntheses that the central urethane units in **7a** and **8a** could be selectively saponified to **7c** and **8c** with anchimeric assistance of the OH groups. The subsequent steps (**c**–**e**) to yield **9** and **10** were carried out following known procedures and were unproblematic;[1c] for the condensation of the highly polar, even in DMF hardly soluble **8c** with *Z*-L-valine, a protocol guaranteeing a low degree of racemization was helpful [activation with the uronium salt TOTU ($[(Me_2N)_2CON{=}C(CN)CO_2Et]^+ BF_4^-$)].[11]



Scheme 4. a) CDI, toluene, RT, 8 h, 53–58%; b) *Z*-valine, iPr_2NEt, TOTU, DMF, RT, 1 h, 67% (based on **8c**); c) MeOH, HCl, 60 °C, 2 h, quant. CDI = 1,1',-carbonyldiimidazole.

The stereochemical variability of the synthetic concept **A** → **B** → **C** → **D** linked with the 1,2-diazacyclic intermediates of type **C** ($n = 1$)[2] is exemplified by the advantageous route from **12** to (2*S*,5*S*)-5-fluoromethylornithine (**13a**, an inhibitor of ornithine aminotransferase[12]) depicted in Scheme 5. Under stereochemical aspects, it is decisive that in the base-



Scheme 5. a) DAST, CH_2Cl_2, RT, 30 min, 74% **14a**; b) MeOH/NH_3 (aq) (4/1), 0 °C, 24 h, 80% **14b**; c) oxalyl chloride, DMSO, NEt_3, CH_2Cl_2, −78 °C, 45 min, quant.; d) iPr_2NEt, dioxane, 70 °C, 12 h; e) $NaClO_2$, 2-methyl-2-butene, *t*BuOH, aq phosphate buffer, RT, 16 h, 89%; f) Li, NH_3 (aq), THF, −78 °C, 15 min, **13a**; g) CH_2N_2, dioxane, RT, 15 min, ca. 50% **13b** (based on **17**). DAST = (diethylamino)sulfur trifluoride.

catalyzed *cis*/*trans* equilibrium between the 3,6-disubstituted hexahydropyridazine diesters *cis*-**15** (3a6e ⇌ 3e6a) and *trans*-**16** (3e6e ⇌ 3a6a) the latter is highly favored owing to the thermodynamic advantage of axial substitution (NMR;[13] in support of this, lactonization is fast in *cis*-**14b**, but not in the *trans*-epimer generated from **16**). Whereas the oxidation **16** → **17** with $NaClO_2$ is straightforward, optimization is still necessary for the subsequent steps **17** → **13b** (preliminarily ca. 50%). This synthetic strategy is clearly applicable to analogous 2*R*,5*R* and 2*R*,5*S* structures.

Further functionalization of the $(CH_2CH_2)_n$ elements implied in formula **A**, as well as cyclization of the dimers (e.g. **E**) available through this synthetic strategy to the

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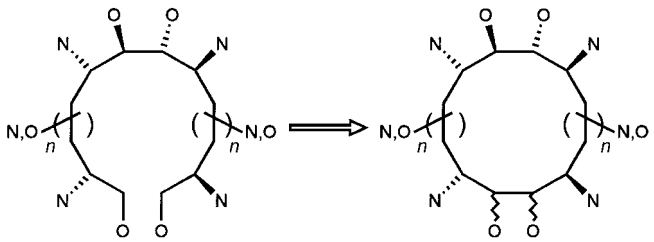

poly(per)functionalized macrocycles (e.g. **F**), are intensively pursued projects.

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[1] For example, the HIV protease inhibitors a) DMP323 (DuPont Merck): P. Y. S. Lam, P. K. Jadhav, C. J. Eyermann, C. N. Hodge, Y. Ru, L. T. Bacheler, J. L. Meek, M. J. Otto, M. M. Rayner, Y. N. Wong, C.-H. Chang, P. C. Weber, D. A. Jackson, T. R. Sharpe, S. Erickson-Viitanen, *Science* **1994**, *263*, 380; L. T. Rossano, Y. S. Lo, L. Anzalone, Y.-C. Lee, D. J. Meloni, J. R. Moore, T. M. Gale, J. F. Arnett, *Tetrahedron Lett.* **1995**, *36*, 4967; P. J. Jadhav, H.-W. Man, *Tetrahedron Lett.* **1996**, *37*, 1153; b) A77003 (Abbott): W. R. Baker, S. L. Condon, *J. Org. Chem.* **1993**, *58*, 3277; M. V. Hosur, T. N. Bhat, D. J. Kempf, E. T. Baldwin, B. Liu, S. Gulnik, N. E. Wideburg, D. W. Norbeck, K. Appelt, J. W. Erickson, *J. Am. Chem. Soc*. **1994**, *116*, 847; G. T. Wang, S. Li, N. Wideburg, G. A. Krafft, D. J. Kempf, *J. Med. Chem.* **1995**, *38*, 2995; c) HBY793 (Hoechst): B. Kammermeier, G. Beck, D. Jacobi, H. Jendralla, *Angew. Chem.* **1994**, *106*, 719; *Angew. Chem. Int. Ed. Engl.* **1994**, *33*, 685; B. Kammermeier, G. Beck, W. Holla, D. Jacobi, B. Napierski, H. Jendralla, *Chem. Eur. J.* **1996**, *2*, 307; S. E. P. Schreiner, A. Pruckner, *J. Org. Chem.* **1997**, *62*, 5380 – 5384.

[2] S. Grabowski, H. Prinzbach, *Tetrahedron Lett.* **1996**, *37*, 7955; S. Grabowski, Dissertation, Universität Freiburg, **1997**.

[3] All new compounds were fully characterized (IR, ^{1}H and ^{13}C NMR spectroscopy, mass spectrometry, elemental analysis); e.g. (+)-**4** ((2*S*,7*R*)-2,7-bis[(ethyloxycarbonyl)amino]-8-methoxymethyloxyoctan-1-al): colorless crystals, m.p. 98 °C (Et_2O/*n*-pentane); $[\alpha]_D^{25} = +4.9$ ($c = 0.4$ in CH_3CN), $[\alpha]_{365}^{25} = +42.3$ ($c = 0.4$ in CH_3CN); IR (KBr): $\tilde{\nu} =$ 1547 (C=O) cm^{-1} (among other signals); ^{1}H NMR (400 MHz, CD_3CN): $\delta = 9.47$ (s, 1-H), 5.89 (br d, NH), 5.41 (br d, NH), 4.56 (s, OCH_2O), 4.08 (q, OCH_2CH_3), 4.05 (q, OCH_2CH_3), 3.97 (m, 2-H), 3.63 (m, 7-H), 3.46 (d, 8-CH_2, $J = 5.4$ Hz), 3.30 (s, OCH_3), 1.67 – 1.26 (m, 4 CH_2) 1.25 (t, OCH_2CH_3), 1.18 (t, OCH_2CH_3); ^{13}C NMR (100.6 MHz, CD_3CN): $\delta = 202.1$ (C-1), 157.4 (C=O), 156.7 (C=O), 97.3 (CH_3O-CH_2O), 70.6 (C-8), 61.7, 61.1 (CH_3CH_2O), 55.5 (CH_3OCH_2O), 55.9, 46.8 (C-2,-7), 32.3, 29.0 (C-3,-6), 26.3, 26.0 (C-4,-5), 15.06, 14.95 (CH_3CH_2O); MS (CI, NH_3): *m/z* (%): 380 (29) [M^++NH_4], 363 (100) [M^++1] (among other signals). **10** ((4*S*,5*R*,6*R*,7*S*)-4,7-bis[(3′R)-3′-(ethyloxycarbonyl)amino-4′-(methoxymethyloxy)butyl]-5,6-bis(triethylsilyloxy)-1,3-diazepin-2-one): ^{1}H NMR (400 MHz, $CDCl_3$): $\delta =$ 5.26 (br d, NH), 4.56 (s, OCH_2O), 4.47 (br s, NH), 4.06 (m, OCH_2CH_3), 3.71 (4-H, 7-H), 3.54 (dd, 4′-CH_2 A), 3.46 (m, 4′-CH_2 B, 3′-H), 3.40 (“s”, 5-H, 6-H), 3.31 (s, OCH_3), 1.74, 1.53 (m, 1′-CH_2, 2′-CH_2), 1.14 (t, OCH_2CH_3), 0.92 (t, $SiCH_2CH_3$), 0.56 (m, $SiCH_2CH_3$); ^{13}C NMR (100.6 MHz, $CDCl_3$): $\delta = 164.8$ (C-2), 156.4 (urethane C=O), 96.8 (OCH_2O), 73.9 (C-5, C-6), 69.8 (C-4′, C-4″), 60.7 (OCH_2CH_3), 55.4 (OCH_3), 51.6 (C-4, C-7)*, 50.8 (C-3′, C-3″)*, 30.3 (C-1′, C-1″)**, 29.2 (C-2′, C-2″)**, 14.7 (OCH_2CH_3), 6.9 ($SiCH_2CH_3$), 5.3 ($SiCH_2CH_3$); MS (ESI: spray 4 – 5 kV, capillary 200 – 250 °C, sheath gas 20 psi): *m/z* (%): 819.5 (3) [M^++K], 803.5 (17) [M^++Na], 781.6 (100) [M^++1], 749 (5) [$M^+ - OCH_3$] (among other signals).

[4] M. T. Reetz, N. Griebenow, *Liebigs Ann.* **1996**, 335.

[5] G. A. Molander, C. R. Harris, *Chem. Rev.* **1996**, *96*, 307; I. L. Chiara, N. Valle, *Tetrahedron: Asymmetry* **1995**, *6*, 1895; T. Sawada, R.Shirai, S. Iwasaki, *Tetrahedron Lett.* **1996**, *37*, 885; I. L. Chiara, M. Martin-Lomas, *Tetrahedron Lett.* **1994**, *35*, 2969; J. P. Guidot, T. LeGall, C. Mioskowski, *Tetrahedron Lett.* **1994**, *35*, 6671.

[6] *Active Metals* (Ed.: A. Fürstner), VCH, Weinheim, **1996**.

[7] T. Wirth, *Angew. Chem.* **1996**, *108*, 65; *Angew. Chem. Int. Ed. Engl.* **1996**, *35*, 61; J. E. McMurry, *Chem. Rev.* **1989**, 1513; A. Fürstner, *Angew. Chem.* **1993**, *105*, 171; *Angew. Chem. Int. Ed. Engl.* **1993**, *32*, 164.

[8] A. W. Konradi, S. F. Pedersen, *J. Org. Chem.* **1992**, *57*, 28 – 32; R. J. Bouma, J. H. Teuben, W. R. Beukema, R. L. Bansemer, J. C. Huffman, K. G. Caulton, *Inorg. Chem*. **1984**, *23*, 2715.

[9] M. E. Pierce, G. D. Harris, Q. Islam, L. A. Radesca, L. Storace, R. E. Waltermire, E. Wat, P. K. Jadhav, G. C. Emmett, *J. Org. Chem.* **1996**, *61*, 444; D. J. Kempf, T. J. Sowin, E. M. Doherty, S. M. Hannick, L. M. Codacovi, R. F. Henry, B. E. Green, S. G. Spanton, D. W. Norbeck, *J. Org. Chem.* **1992**, *57*, 5692.

[10] A. K. Ghosh, S. P. McKee, W. J. Thompson, *Tetrahedron Lett.* **1991**, *32*, 5729; D. J. Kempf, D. W. Norbeck, L. M. Codacovi, X. C. Wang, W. E. Kohlbrenner, N. E. Wideburg, D. A. Paul, M. F. Knigge, S. Vasavanonda, A. Craig-Kennard, A. Saldivar, W. Rosenbrook, Jr., J. J. Clement, J. J. Plattner, J. Erickson, *J. Med. Chem.* **1990**, *33*, 2687.

[11] W. König, G. Breipohl, P. Pokorny, M. Birkner in *Proceedings of the Peptides, 21st European Peptide Symposium 1990* (Eds.: E. Giralt, D. Andreu), ESCOM, Leiden, **1991**, pp. 143 – 145.

[12] J. B. Ducep, B. Heintzelmann, K. Jund, B. Lesur, M. Schleimer, P. R. Zimmermann, *Tetrahedron: Asymmetry* **1997**, *8*, 327, and references therein.

[13] Y. Shvo in *The Chemistry of Functional Groups*: *Hydrazo-, Azo-, Azoxy-Compounds, Part 2* (Ed.: S. Patai), Wiley, **1975**, p. 1074; see also A. K. Forrest, R. R. Schmidt, G. Huttner, I. Jibril, *J. Chem. Soc. Perkin trans. 1* **1984**, 1981.

The π-Pyrrole Complexation of Alkali Metal Ions by Zirconium *meso*-Octaalkylporphyrinogens: Encapsulation of Li_4H_4 and Li_2O in Sandwich Structures**

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Much attention has been focused on methodologies that allow ionic compounds to be carried into a nonpolar organic phase, either as an ion pair or in an ion-separated form.[1] For alkali metal salts and polar organometallic compounds, two

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