suggests a potential application of this approach in the study of protein-structure dynamics.

Experimental Section

All peptide synthesis were carried out according to the in situ neutralization/HBTU activation protocol for Boc solid-phase peptide synthesis (HBTU = benzotriazol-1-yl-*N*-tetramethyluronium hexafluorophosphate).[16] Peptide thioester **1** was prepared by selective thioesterification of the corresponding peptide thioacid (prepared on a glycine–thioester support)[17] with 5,5′-dithiobis(2-nitrobenzoic acid) (DTNB, Ellman's reagent) as previously described[5a] and purified by preparative HPLC. ES-MS: observed mass: 5546.3(1.4) Da; calcd for $C_{244}H_{361}N_{65}O_{76}S_4$: 5545.5 (monoisotopic), 5549.0 (average isotope composition).

Cyclization: Purified **1** (0.4 μmol, 2.2 mg) was dissolved to a final concentration of about 50 μM in a freshly degassed buffer containing 0.1 M sodium phosphate and 1 mM ethylenediamine tetraacetate (EDTA) at pH 7.5 and 0.05 volume % each of PhSH and BnSH. In cyclization reactions carried out under unfolding conditions, 6 M GdmCl was included in the above buffer. To monitor the course of the reaction, small aliquots (50 μL) of the reaction mixture were periodically removed, quickly quenched by addition of 5% trifluoroacetic acid in water (20 μL), and investigated by analytical HPLC. The degree of conversion of **1** into **2** was calculated based on the absorption at 280 nm. The overall yield for the cyclization reaction following HPLC purification was 1.8 mg (0.32 μmol, 81%). Circular protein **2** was characterized by ES-MS and tryptic digestion. ES-MS: observed mass: 5348.5(1.0) Da; calcd for $C_{237}H_{356}N_{64}O_{72}S_3$: 5346.5 (monoisotopic), 5350.0 (average isotope composition).

Tryptic digestion of **2**: Cyclic **2** (100 μg) was dissolved in 0.1 M tris(hydroxymethyl)aminomethane (Tris)/HCl buffer (pH 8.4, 200 μL). Lyophilized trypsin (10 μg, sequencing grade, Sigma) was then added, and the reaction maintained at 37 °C for 3 h; a solution of 1,4-dithiothreitol (DTT, 50 mM, 20 μL) was subsequently added. The three expected fragments T1 (H–AMLSQGCFEIPDDVPLPAGWEMAK–OH), T2 (H–TSSGQR–OH), and T3 (H–YFLNHIDQTTTWQDPR–OH) were isolated by HPLC and characterized by ES-MS and Edman sequencing.

The isotherms for ligand binding were obtained by monitoring the intrinsic Trp fluoresence at 340 nm as a function of the concentration of the ligand at 22 °C. In all cases, the protein concentration was kept at 2 μM in a buffer containing 40 mM sodium phosphate, 50 mM NaCl, and 1 mM DTT at pH 7.2. Equilibrium dissociation constants were extracted from the curves by assuming a 1:1 receptor–ligand complex.[18]

Two-dimensional ^{1}H NMR spectra were measured on a Bruker DPX-400 spectrometer (400.132 MHz). The NMR samples were dissolved in a buffer containing 10 mM sodium phosphate, 100 mM NaCl, 1 mM [D_{10}]DTT, 0.02% NaN_3, and 10% D_2O at pH 6.2. A series of TOCSY and NOESY experiments[19] were recorded at 278 K on samples containing both linear and circular WW domains with WW ligand (protein concentrations 0.6–1.2 mM; ratio of peptide to protein 3:1). Typical mixing times were 30 ms for TOCSY experiments and 50–250 ms for NOESY experiments.

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[1] a) T. W. Muir, *Structure* **1995**, *3*, 649–652; b) C. J. A. Wallace, *Curr. Opin. Biotech.* **1995**, *6*, 403–410.
[2] a) P. E. Dawson, S. B. H. Kent, *J. Am. Chem. Soc.* **1993**, *115*, 7263–7266; b) A. Nefzi, X. Sun, M. Mutter, *Tetrahedron Lett.* **1995**, *36*, 229–230; c) L. E. Canne, A. R. Ferre-D'Amare, S. K. Burley, S. B. H. Kent, *J. Am. Chem. Soc.* **1995**, *117*, 2998–3007; d) J. Shao, J. Tam, *ibid.* **1995**, *117*, 3893–3899; e) K. J. Rose, *ibid.* **1994**, *116*, 30–33 ; f) T. W. Muir, M. J. Williams, M. H. Ginsberg, S. B. H. Kent, *Biochemistry* **1994**, *33*, 7701–7708.
[3] a) D. P. Goldenberg, T. E. Creighton, *J. Mol. Biol.* **1984**, *179*, 527–545; b) D. P. J. Goldenberg, *J. Cell. Biochem.* **1985**, *29*, 321–335; c) D. P. Goldenburg, T. E. Creighton, *J. Mol. Biol.* **1983**, *165*, 407–413.
[4] a) V. J. Hruby, *Life Science* **1982**, *31*, 189–199; b) H. Kessler, *Angew. Chem.* **1982**, *94*, 509–520 ; *Angew. Chem. Int. Ed. Engl.* **1982**, *21*, 512–523; c) J. Rizo, L. M. Gierasch, *Ann. Rev. Biochem.* **1992**, *61*, 387–418.
[5] a) J. A. Camarero, T. W. Muir, *Chem. Commun.*, **1997**, 1369–1370; b) L. Zhang, J. P. Tam, *J. Am. Chem. Soc.* **1997**, *119*, 2363–2370.
[6] P. E. Dawson, T. W. Muir, I. Clark-Lewis, S. B. H. Kent, *Science* **1994**, *266*, 776–779.
[7] WW domains are a novel class of protein modules which are found in a variety of signal-transducing and cytoskeletal proteins. Reviews: a) M. Sudol, *Prog. Biophys. Molec. Biol.* **1996**, *65*, 113–132; b) M. Sudol, H. I. Chen, C. Bougeret, A. Einbond, P. Bork, *FEBS Letters* **1995**, *369*, 67–71.
[8] M. J. Macias, M. Hyvonen, E. Baraldi, J. Schultz, M. Sudol, M. Saraste, H. Oschkinat, *Nature* **1996**, *382*, 646–649.
[9] To facilate native ligation, Cys and Gly were added at the N and C termini, respectively, of the core WW sequence (residues 165–209 of the human YAP protein).
[10] Cyclic protein **2** was digested with trypsin, and the peptide fragment encompassing the ligation site (AMLSQ**GC**FEIPDDVPLPAG-WEMAK) characterized by Edman sequencing.
[11] H. I. Chen, M. Sudol, *Proc. Natl. Acad. Sci. USA* 1995, 92, 7819–7823.
[12] The linear WW domain was also chemically synthesized by Boc solid-phase protein synthesis and purified by standard procedures.
[13] Residues located at the immediate N and C termini could not be unambiguously assigned in either the linear or cyclic WW domains.
[14] Large effective molarities were described for many intramolecular organic reactions: F. M. Menger, *Acc. Chem. Res.* **1985**, *18*, 128–134.
[15] B. Li, J. Y. K. Tom, D. Oare, R. Yen, W. J. Fairbrother, J. A. Wells, B. C. Cunningham, *Science* **1995**, *270*, 1657–1660.
[16] M. Schnolzer, P. Alewood, A. Jones, D. Alewood, S. B. H. Kent, *Int. J. Pept. Protein Res.* **1992**, *40*, 180–193.
[17] D. Yamashiro, C. H. Li, *Int. J. Pept. Protein Res.* **1988**, *31*, 322–334.
[18] A. R. Viguera, J. L. Arrondo, A. Musacchio, M. Saraste, L. Serrano, *Biochemistry* **1994**, *33*, 10925–10933.
[19] a) A. Bax, D. G. Davis, *J. Magn. Reson.* **1985**, *65*, 355–360; b) A. Kumar, R. R. Ernst, K. Wuthrich, *Biochem. Biophys. Res. Commun.* **1980**, *95*, 1–6.

A Symmetrically Bridging Triarylsilyl Ligand in a Dinuclear Rhodium Complex: Synthesis and Structure of [LRh(H)(μ-Cl)(μ-SiAr$_2$)(μ-SiAr$_3$)Rh(H)L] (Ar = Ph, *p*-FC$_6$H$_4$; L = P*i*Pr$_3$)**

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Bridging coordination of a secondary silyl group ($SiHR_2$) in dinuclear complexes has become common for late transition metals.[1] The complexes reported so far contain both a σ bond between Si and one metal and a three-center, two-electron bond (3c–2e; π bond) between the Si–H group and the second metal center (Scheme 1a).

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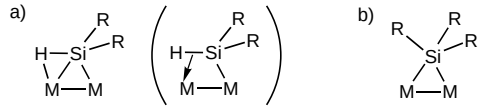


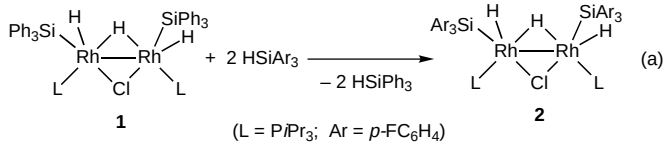
Scheme 1. Common (a) and seldom (b) coordination modes of secondary and tertiary silyl groups in dinuclear metal complexes.

The μ-η^1,η^2-coordination of the ligand results in two M–Si bond lengths that are significantly different from each other. Complexes with a tertiary silyl ligand in a bridging coordination (Scheme 1b) seem to be less stable than with a primary or secondary silyl ligand, since it has no Si–H group to stabilize M-Si-M coordination by Si-H-M 3c–2e bonding. Multinuclear Cu complexes whose metal centers are bridged by extremely bulky $Si(SiMe_3)_3$ ligands were isolated.[2] Dinuclear complexes with a bridging tertiary silyl ligand are of interest as models for the transition state of the migration of the tertiary silyl ligand from one metal to the other in a dinuclear framework (Scheme 2).[3, 4] Bridging coordination of PR_3 ligands that are isolobal to SiR_3^- ligands has already been

Scheme 2. Migration of a tertiary silyl group to the second metal center in dinuclear metal complexes.

established.[5] Here we report the synthesis and structure of novel dinuclear Rh complexes with a bridging triarylsilyl ligand that coordinates symmetrically to the two Rh centers.

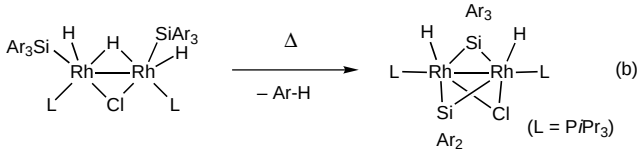
Complex **1**[6] is readily converted into its fluorine-substituted derivative **2**[7] [Eq. (a)]. Both **1** and **2** undergo thermal



(a)

(L = P*i*Pr$_3$; Ar = *p*-FC$_6$H$_4$)

reaction at 70 °C in toluene to afford complexes **3** and **4** under liberation of benzene and fluorobenzene, respectively, in quantitative yields [Eq. (b)].



(b)

1: Ar = C_6H_5, **2**: Ar = *p*-FC_6H_4 **3**: Ar = C_6H_5, **4**: Ar = *p*-FC_6H_4

Figure 1 shows the molecular structure of **4**, which has two Rh centers bridged by chloride, bis(4-fluorophenyl)silylene, and tri(4-fluorophenyl)silyl ligands.[8] The distances from the Rh centers to the Si atom of the triarylsilyl ligand are similar (2.444(4), 2.487(3) Å) and significantly longer than the bond lengths between the Si center of the silylene ligand and the Rh

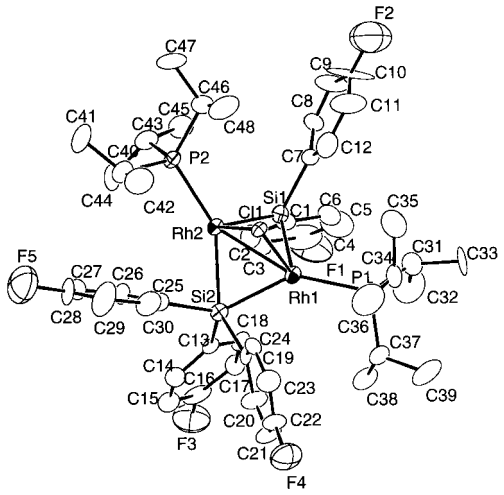


Figure 1. A perspective ORTEP drawing of the crystal structure of **4**. Selected bond lengths [Å] and angles [°]: Rh1–Rh2 2.684(2), Rh1–P1 2.320(4), Rh2–P2 2.337(3), Rh1–Cl1 2.551(3), Rh2–Cl1 2.534(3), Rh1–Si1 2.290(2), Rh2–Si1 2.250(3), Rh1–Si2 2.444(4), Rh2–Si2 2.487(3), Si1–C1 1.91(1), Si1–C7 1.90(2), Si2–C13 1.90(1), Si2–C19 1.931(8), Si2–C25 1.88(1); P1-Rh1-Rh2 160.10(10), P2-Rh2-Rh1 153.5(1), P1-Rh1-Cl1 111.2(1), P2-Rh2-Cl1 105.2(1), P1-Rh1-Si1 114.7(1), P2-Rh2-Si1 110.2(1), P1-Rh1-Si2 142.0(1), P2-Rh2-Si2 149.6(1), Rh1-Si1-Rh2 72.48(8), Rh1-Si1-C1 120.3(3), Rh1-Si1-C7 118.7(4), Rh2-Si1-C1 124.4(5), Rh2-Si1-C7 115.6(3), C1-Si1-C7 104.0(5), Rh1-Si2-Rh2 65.94(10), Rh1-Si2-C13 118.2(4), Rh1-Si2-C19 80.4(4), Rh1-Si2-C25 133.8(5), Rh2-Si2-C13 123.6(3), Rh2-Si2-C19 129.4(4), Rh2-Si2-C25 77.6(4), C13-Si2-C19 105.1(4), C13-Si2-C25 105.2(6), C19-Si2-C25 103.9(4).

centers (2.290(3), 2.250(3) Å). They are longer than the Rh–Si bond lengths already reported (2.203–2.379 Å)[9] and comparable even to that in a Rh-H-Si 3c–2e bond (2.487 Å).[1d] This is in contrast to the structure of Cu complexes containing $Si(SiMe_3)_3$ ligands, in which the Cu–Si bonds to the bridging and nonbridging ligands do not show significant differences in length.[3] The NMR spectra of **3** and **4** are consistent with the above structure. The ^{1}H NMR spectra show peaks due to two equivalent nonbridging hydrido ligands at $\delta = -17.40$ and -17.60, respectively;[10] the positions of the hydrogen atoms were not determined in the crystal structure analysis of **4**.

The ^{1}H and ^{31}P{^{1}H} NMR spectroscopic measurements of the thermal transformation of **1** to **3** in C_6D_6 revealed there are no Rh complexes other than **1** and **3** throughout the reaction. Conversion of **1** into **3** obeys first-order kinetics ($k = 4.41 \times 10^{-5}\ s^{-1}$ at 333 K). This indicates that the reaction proceeds in an intramolecular fashion, most probably by oxidative addition of a Si–C bond of an arylsilyl ligand onto the metal center followed by coupling of the phenyl group of this ligand with a hydride ligand and release of benzene. Activation of Si–C bonds under mild conditions has been found for reactions of various organotransition metal complexes.[1g, 11]

We succeeded in isolating rhodium complexes with a symmetrically bridging triarylsilyl ligand. The complexes show unexpectedly thermal stability, although the Rh–Si bond is significantly longer than common Rh–Si single bonds. Smooth conversion of a nonbridging triarylsilyl ligand into a bridging one corroborates the proposed mechanism for migration of the silyl ligand between the metal centers in dinuclear complexes (Scheme 2).

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Experimental Section

3: A solution of **1** (264 mg, 0.24 mmol) in toluene (5 mL) was stirred for 2 h at 70 °C. During the reaction the color of the solution changed from yellow to orange. Gas-chromatographic analysis of the solution showed quantitative formation of benzene. The $^{31}P\{^1H\}$ NMR spectrum of the mixture after the reaction showed only the signal for **3**. Addition of pentane caused separation of **3** as yellow-orange crystals, which were collected by filtration and recrystallized from toluene/pentane (71 mg, 29% yield). The similar reaction of **2** gave **4** in 51% yield.

The kinetic measurements of the conversion were carried out in a thermostatted (70 °C) NMR probe by following the changes in the intensities of the ^1H NMR signal for the hydrido ligands of **1**. Dioxane was used as an internal standard.

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[1] a) W. A. G. Graham, *J. Organomet. Chem.* **1986**, *300*, 81, and references therein; b) U. Schubert, *Adv. Organomet. Chem.* **1990**, *30*, 151, and references therein; c) R. Carreño, V. Riera, M. A. Ruiz, Y. Jeannin, M. Philoche-Levisalles, *J. Chem. Soc. Chem. Commun.* **1990**, 15; d) M. D. Fryzuk, L. Rosenberg, S. J. Rettig, *Organometallics* **1991**, *10*, 2537; *ibid.* **1996**, *15*, 2871; e) H. Suzuki, T. Takao, M. Tanaka, Y. Moro-oka, *J. Chem. Soc. Chem. Commun.* **1992**, 476; f) T. Takao, S. Yoshida, H. Suzuki, M. Tanaka, *Organometallics* **1995**, *14*, 3855; g) B. K. Campion, R. H. Heyn, T. D. Tilley, *ibid*. **1992**, *11*, 3918; h) R. S. Simons, C. A. Tessier, *ibid*. **1996**, *15*, 2604.

[2] a) A. Heine, D. Stalke, *Angew. Chem.* **1993**, *105*, 90; *Angew. Chem. Int. Ed. Engl.* **1993**, *32*, 121; b) A. Heine, R. Herbest-Irmer, D. Stalke, *J. Chem. Soc. Chem. Commun.* **1993**, 1729.

[3] a) P. Braunstein, M. Knorr, B. Hirle, G. Reinhard, U. Schubert, *Angew. Chem.* **1992**, *104*, 1641; *Angew. Chem. Int. Ed. Engl.* **1992**, *31*, 1583; b) M. Knorr, P. Braunstein, A. Tiripicchio, F. Ugozzoli, *Organometallics* **1995**, *14*, 4910; c) M. Knorr, E. Hallauer, V. Huch, M. Veith, P. Braunstein, *ibid*. **1996**, *15*, 3868.

[4] W. Lin, S. R. Wilson, G. S. Girolami, *Organometallics* **1994**, *13*, 2309.

[5] R. Bender, P. Braunstein, A. Dedieu, Y. Dusausoy, *Angew. Chem.* **1989**, *101*, 931, *Angew. Chem. Int. Ed. Engl.* **1989**, *28*, 923.

[6] K. Osakada, T. Koizumi, T. Yamamoto, *Organometallics* **1997**, *16*, 2063.

[7] **2**: ^1H NMR (C_6D_6, TMS): $\delta = 7.59$ (dd, $^3J(H,H) = 9$, $^3J(H,F) = 2$ Hz, 12H; aromatic H), 6.90 (t, $^3J(H,H) = {}^3J(H,F) = 9$ Hz, 12H; aromatic H), 1.54 (m, $^3J(P,H) = 7$ Hz, 6H; P–CH), 0.82 (br, 36H; CH_3), −12.55 (tt, $^1J(Rh,H) = 58$, $^2J(P,H) = 25$ Hz, 1H; Rh-H-Rh), −16.07 (AA′ part of an AA′MM′XX′ pattern, 2H; Rh–H); $^{31}P\{^1H\}$ NMR (C_6D_6, 85% H_3PO_4): $\delta = 54.2$ (AA′ part of an AA′XX′ pattern).

[8] Crystallographic data for **4**: $C_{48}H_{64}ClF_5P_2Rh_2Si_2$, $M_r = 1095.41$, monoclinic, space group $P2_1/c$ (no. 14), $a = 18.146(10)$, $b = 12.806(8)$, $c = 21.512(9)$ Å, $\beta = 90.39(3)°$, $V = 4998$ Å^3, $Z = 4$, $\mu = 8.74$ cm^{-1}, $F(000) = 2248$, $\rho_{calcd} = 1.455$ g cm^{-3}. The final R factor was 0.075 ($Rw = 0.059$) for 7999 reflections with $I > 3\sigma(I)$. Data collection on a RIGAKU-AFC5R diffractometer at 298 K with graphite-monochromated $Mo_{K\alpha}$ radiation ($\lambda = 0.71073$ Å). The structure was solved with the program teXsan. Crystallographic data (excluding structure factors) for the structure reported in this paper have been deposited with the Cambridge Crystallographic Data Centre as supplementary publication no. CCDC-100766. Copies of the data can be obtained free of charge on application to CCDC, 12 Union Road, Cambridge CB2 1EZ, UK (fax: int. code + (49) 1223-336033; e-mail: deposit@ccdc.cam.ac.uk).

[9] a) K. W. Muir, J. A. Ibers, *Inorg. Chem.* **1970**, *9*, 440; b) M.-J. Fernandez, P. M. Bailey, P. O. Bentz, J. S. Ricci, T. F. Koetzle, P. M. Maitlis, *J. Am. Chem. Soc.* **1984**, *106*, 5458; c) F. L. Joslin, S. R. Stobart, *J. Chem. Soc. Chem. Commun.* **1989**, 504; d) D. L. Thorn, R. L. Harlow, *Inorg. Chem.* **1990**, *29*, 2017; e) K. Osakada, K. Hataya, Y. Nakamura, M. Tanaka, T. Yamamoto, *J. Chem. Soc. Chem. Commun.* **1993**, 576; *ibid.* **1995**, 2315.

[10] **3**: ^1H NMR (C_6D_6, TMS): $\delta = 6.9 - 8.2$ (m, 25H; aromatic H), 1.18 (m, $^3J(P,H) = 7$ Hz, 6H; P–CH), 0.95 (m, 36H; CH_3), −17.40 (AA′ part of an AA′MM′XX′ pattern, 2H; Rh–H); $^{31}P\{^1H\}$ NMR (C_6D_6, 85% H_3PO_4): $\delta = 57.4$ (AA′ part of an AA′XX′ pattern); $^{29}Si\{^1H\}$ NMR (C_6D_6, TMS): $\delta = 157.8$ (t, $^2J(P,Si) = 50$ Hz), 28.7 (tt, $^2J(P,Si) = 50$, $^1J(Rh,Si) = 8$ Hz). **4**: ^1H NMR (C_6D_6, TMS): $\delta = 6.76 - 7.88$ (m, 20H; aromatic H), 1.12 (m, 6H; P–CH), 0.86 (m, 36H; CH_3), −17.60 (AA′ part of an AA′MM′XX′ pattern, 2H; Rh–H); $^{31}P\{^1H\}$ NMR (C_6D_6, 85% H_3PO_4): $\delta = 58.2$ (AA′ part of an AA′XX′ pattern).

[11] a) M. Auburn, M. Ciriano, J. A. K. Howard, M. Murray, N. J. Pugh, J. L. Spencer, F. G. A. Stone, P. Woodward, *J. Chem. Soc. Dalton Trans.* **1980**, 659; b) D. E. Hendriksen, A. A. Oswald, G. B. Ansell, S. Leta, R. V. Kastrup, *Organometallics* **1989**, *8*, 1153; c) S. K. Thomson, G. B. Young, *ibid*. **1989**, *8*, 2068; d) P. Burger, R. G. Bergman, *J. Am. Chem. Soc.* **1993**, *115*, 10462; e) T. Rappert, O. Nürnberg, H. Werner, *Organometallics* **1993**, *12*, 1359; f) M. Baum, B. Windmüller, H. Werner, *Z. Naturforsch. B* **1994**, *49*, 859; g) D. Huang, R. H. Heyn, J. C. Bollinger, K. G. Caulton, *Organometallics* **1997**, *16*, 292.

A Glucose-Containing Ether Lipid (Glc-PAF) as an Antiproliferative Analogue of the Platelet-Activating Factor**

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It has long been known that the platelet-activating factor (PAF) is a biologically highly active phosphoglyceride,[1] and various PAF analogues have been reported as inhibitors of proliferation.[2] However, since synthetic phospholipids are strongly cytotoxic, their therapeutic use has hitherto been restricted to topical applications.[3] We reported earlier the synthesis of a new type of glyceroglucolecithin (Glc-PC)[4] which displayed antiproliferative activity without cytotoxicity at concentrations below 10 μmol L^{-1}. We now present the glycoside of the ether analogue [1-*O*-octadecyl-2-*O*-α-D-glucopyranosyl-*sn*-glycero(3)]phosphorylcholine (Glc-PAF, **1**), which is formally derived from the PAF by exchanging the 2-acyl group for a glucose molecule.

The glycerol skeleton is provided by the starting material (*S*)-isopropylidene glycerol (**2**),[5] whose hydroxyl group is protected as the allyl ether functionality in **3** for introduction of the end groups (Scheme 1). The primary hydroxyl group of the diol **4** released upon acid hydrolysis cannot react directly to form an ether, and it is therefore first converted into a terminal benzoate ester group.[6] Compound **5** undergoes

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