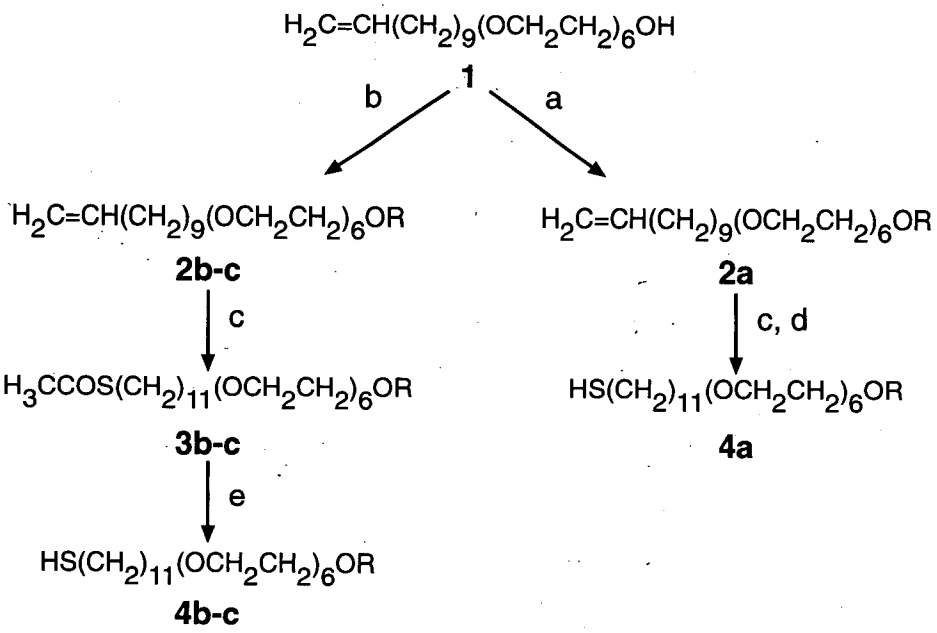
## Synthesis of Alkanethiols 4a-c

**Materials.** Reactions were monitored by thin layer chromatography (TLC) using 0.25-mm silica gel plates (E. Merck). Column chromatography was performed using silica gel-60 (particle size 0.040-0.063) (E. Merck). All reactions in non-aqueous solvents were executed under nitrogen. Two batches of $HS(CH_2)_{11}(EG)_3OH$, and compound **1** were synthesized using published procedures.

**Procedures.** Alkanethiols **4a-c** were synthesized in three steps starting from $EG_6OH$ **1** (Scheme I). Alcohol **1** was initially allowed to react with RBr (R = $C(C_6H_5)_3$ (**a**), $CH(C_6H_5)_2$ (**b**), $CH_2(C_6H_5)$ (**c**)) to furnish the ethers **2a- c**. The terminal olefins of **2a-c** were then converted to the alkanethiols by radical addition of thiolacetic acid followed by hydrolysis of the resulting thioesters. We found that for R = $CH(C_6H_5)_2$, $CH_2(C_6H_5)$, the purification of the final product was



a) $(Ph)_3CBr$, DMF-Pyr; b) NaH, THF, RBr (R = $CH(C_6H_5)_2$ (**b**), $CH_2(C_6H_5)$ (**c**)); c) $CH_3COSH$, AIBN, hν; d) NaOH, $H_2O$; e) $NaOCH_3$, $CH_3OH$

**Scheme I.** Synthesis of compounds **4a-c**.

easier if the radical addition of the thiolacetic acid, and the hydrolysis of the thioesters were performed in two separate steps, each followed by purification with column chromatography, than if the two steps were performed in the same reaction vessel as in the case when R = $C(C_6H_5)_3$.

***Undec-1-en-11-yl-hexa(ethyleneglycol) triphenylmethyl ether (2a).*** Alcohol **1** (783 mg, 1.802 mmol) in 10 mL of DMF and 1 mL of triethylamine was stirred for 15 min. Trityl bromide (759 mg, 1.32 equiv.) and DMAP (60 mg, 0.3 equiv.) were then added, respectively. After stirring for 18 h at room temperature, solvent was removed at reduced pressure. The crude product was purified by chromatography (9:1 $CH_2Cl_2$/MeOH) to obtain 0.987 mg (84%) of **2a** ($R_f$ = .5). $^1$H NMR (400 MHz, CDCl3) δ 1.29 (br s, 12 H), 1.55 (qui, 2 H, J = 7 Hz), 2.05 (q, 2 H, J = 7 Hz), 3.45 (t, 2 H, J = 7 Hz), 3.55-3.92 (m, 24 H), 4.91-5.02 (m, 2 H), 5.75-5.85 (m, 1 H), 7.19-7.49 (m, 15 H).

***1-Mercaptoundec-11-yl-hexa(ethyleneglycol) triphenylmethyl ether (4a).*** Olefin **2a** (680 mg, 1.042 mmol) was dissolved in 8 mL of distilled tetrahydrofuran, together with 0.744 mL of thiolacetic acid (10 equiv.) and 30 mg of azobis(isobutyronitrile) (AIBN). After irradiating the solution for 4 h under a 450 W medium pressure mercury lamp (Ace Glass) in a pyrex flask, 1 mL of 2N aqueous NaOH was added. The reaction mixture was stirred for an additional 30 min, concentrated and purified by flash chromatographhy (9:1 $CH_2Cl_2$/MeOH) to obtain

658 mg (89%) of **4a** ($R_f$ = 0.5). $^1$H NMR (400 MHz, CDCl3) δ 1.29 (br s, 12 H), 1.32 (t, 1 H, J = 7 Hz), 1.58 (m, 4 H), 2.51 (q, 2 H, J = 7 Hz), 3.23 (t, 1 H), 3.45 (t, 2 H, J = 7 Hz), 3.55-3.68 (m, 24 H), 7.19-7.47 (m, 15 H). FABMS: 733 $[M+Na]^+$ and 243 $[Trityl]^+$. HR FABMS: m/z calculated for $[C_{42}H_{62}O_7S + Na]^+$ 733.4114; found 733.4129. Anal. Calcd for $C_{42}H_{62}O_7S$: C, 70.95; H, 8.79; O, 15.75; S, 4.51. Found: C, 70.83; H, 8.64; O, 15.55; S, 4.75.

***Undec-1-en-11-yl-hexa(ethyleneglycol) diphenylmethyl ether (2b).*** Alcohol **1** (434 mg, 2.1 mmol) was dissolved in 20 mL of distilled THF with sodium hydride (60% dispersion in oil, 186 mg, 4.65 mmol) and stirred for 20 min. Diphenyl bromomethane (1.04 g, 4 mmol) in 10 mL of THF was then added to the reaction mixture. After stirring for 16 h at room temperature, the reaction was quenched with methanol and solvent was removed at reduced pressure. The crude product was purified by chromatography (98:2 $CH_2Cl_2$/MeOH) to obtain 1.146 g (91%) of **2b** ($R_f$ = 0.25) that was used directly in the next step. $^1$H NMR (300 MHz, CDCl3) δ 1.27 (br s), 1.58 (qui), 2.02 (q), 3.44 (t), 3.55-3.73 (m), 4.90-5.01 (m), 5.41 (s), 5.65-5.75 (m), 7.20-7.37 (m).

***[1-[(Methylcarbonyl)thio]undec-11-yl]hexa(ethyleneglycol) diphenylmethyl ether (3).*** Olefin **3b** (1.146 g, 1.91 mmol) was dissolved in 20 mL of distilled THF, together with 1.4 mL of thiolacetic acid (10 equiv., 19.1 mmol) and 30 mg of AIBN. After irradiating the solution for 16 h under a 450 W medium pressure mercury lamp (Ace Glass) in a pyrex flask, and removing the solvent at reduced pressure, the crude product was purified twice by chromatography (98:2 $CH_2Cl_2$/MeOH) to obtain 0.959 g (74%) of **3b** (Rf = 0.2). $^1$H NMR (300 MHz, CDCl3) δ 1.27 (br s), 1.60 (qui), 2.32

(s), 2.86 (t), 3.44 (t), 3.56-3.71 (m), 5.41 (s), 7.21-7.34 (m). FABMS: 699 $[M+Na]^+$ and 623 $[M-CH_3COSH_2+Na]^+$.

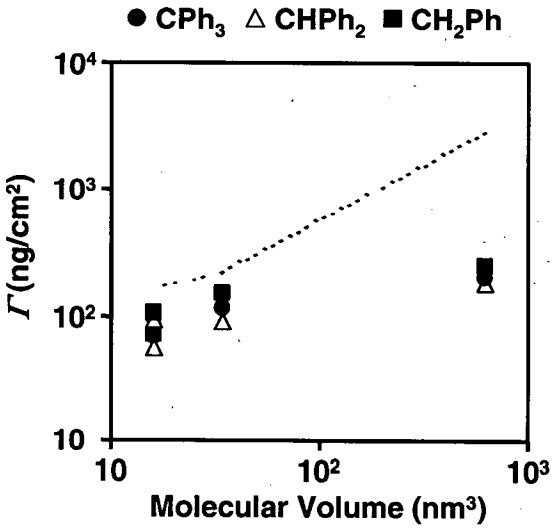
***1-Mercaptoundec-yl-hexa(ethyleneglycol) diphenylmethyl ether (4b).*** Thioacetate **3b** (0.959 g, 1.42 mmol) was dissolved in 4 mL of freshly distilled dichloromethane and 20 mL of thoroughly degassed methanol. A solution of $NaOCH_3$ (1.8mmol, 1.36 mL, 1.32 M in $CH_3OH$) was added to the reaction mixture. After stirring for 1 h at room temperature, the reaction mixture was brought to neutral pH with D, L-camphorsulfonic acid, concentrated, and purified by flash chromatography (Silica Gel H, 98:2 $CH_2Cl_2$/MeOH) to obtain 658 mg (89%) of **4b** ($R_f = 0.15$). $^1H$ NMR (300 MHz, CDCl3) δ 1.26 (br s, 12 H), 1.57 (m, 4 H), 2.52 (q, 2 H, J = 7 Hz), 3.44 (t, 2 H, J = 7 Hz), 3.56-3.73 (m, 24 H), 5.41 (s, 1 H), 7.23-7.36 (m, 10 H). FABMS: 657 $[M+Na]^+$ and 623 $[M-H_2S+Na]^+$. HR FABMS: m/z calculated for $[C_{36}H_{58}O_7S+Na]^+$ 657.3801; found 657.3825.

***Undec-1-en-11-yl-hexa(ethyleneglycol) phenylmethyl ether (2c).*** Alcohol **1** (1.222 g, 2.8 mmol) was dissolved in 25 mL of freshly distilled THF with sodium hydride (60% dispersion in oil, 231 mg, 5.8 mmol) and stirred for 20 min. Benzyl bromide (963 mg, 5.6 equiv.) was then added to the reaction mixture. After stirring for 6 h at room temperature, the reaction was quenched with methanol and solvent was removed at reduced pressure. The crude product was purified by chromatography (98:2 $CH_2Cl_2$/MeOH) to obtain 1.214 g (83%) of **2c** ($R_f = 0.3$). $^1H$ NMR (300 MHz, CDCl3) δ 1.28 (br s), 1.57 (qui), 2.03 (q), 3.44 (t), 3.55-3.71 (m), 4.56 (s), 4.90-5.02 (m), 5.70-5.90 (m), 7.26-7.35 (m). FABMS: 547 $[M+Na]^+$.

***[1-[(Methylcarbonyl)thio]undec-11-yl]hexa(ethyleneglycol) phenylmethyl ether (3c).*** Olefin **2c** (1.214 g, 2.3 mmol) was dissolved in 25 mL of distilled THF, together with 2.0 mL of thiolacetic acid (12 equiv., 28 mmol) and 30 mg of AIBN. After irradiating the solution for 14 h under a 450 W medium pressure mercury lamp (Ace Glass) in a pyrex flask, and removing the solvent at reduced pressure, the crude product was purified twice by chromatography (98:2 $CH_2Cl_2$/MeOH) to obtain 1.190 g (86%) of **3c** (Rf = 0.2). $^1$H NMR (300 MHz, CDCl3) δ 1.27 (br s), 1.57 (qui), 2.32 (s), 2.86 (t), 3.43 (t), 3.56-3.69 (m), 4.57 (s), 7.33-7.35 (m). FABMS: 623 $[M+Na]^+$ and 547 $[M-CH_3COSH_2+Na]^+$.

***1-Mercaptoundec-11-yl hexa(ethyleneglycol) phenylmethyl ether (4c).*** Compound **3c** (1.190 g, 1.98 mmol) was dissolved in 20 mL of thoroughly degassed methanol and 5 mL of freshly distilled dichloromethane. A solution of $NaOCH_3$ (2.4 mmol, 1.94 mL, 1.236 M in $CH_3OH$) was added to the reaction mixture. After stirring for 1 h. at room temperature, the reaction mixture was brought to neutral pH with D, L-camphorsulfonic acid, concentrated and purified twice by flash chromatography (Silica Gel H, 98:2 $CH_2Cl_2$/MeOH) to obtain 658 mg (60%) of **4c** ($R_f$ = 0.15). $^1$H NMR (300 MHz, CDCl3) δ 1.26 (br s, 12 H), 1.57 (m, 4 H), 2.51 (q, 2 H, J = 7 Hz), 3.42 (t, 2 H, J = 7 Hz), 3.55-3.70 (m, 24 H), 4.57 (s, 2 H), 7.27-7.35 (m, 5 H). FABMS: 581 $[M+Na]^+$ and 547 $[M-H_2S+Na]^+$. HR FABMS: m/z calculated for $[C_{30}H_{54}O_7S + Na]^+$ 581.3488; found 581.3502.

**Figure 1.** Plot of $\Gamma$(ng/cm$^2$, eq. 2) as a function of the molecular volume of the proteins (Table 1) adsorbed to single-component SAMs of $HS(CH_2)_{11}EG_6OR$ where R = $CPh_3$ (●), $CHPh_2$ (△), and $CH_2Ph$ (■). The measurements were performed on separate days and with different solutions of protein; therefore, on each day, we also measured the adsorption of each protein to SAMs of $HS(CH_2)_{15}CH_3$. The values of $\Gamma$ measured on surfaces presenting methyl groups were within 10% of what we measured on surfaces that present R groups. We use log scales for both sets of axes to ease the visualization of the data points. The error bars represent the range of the measured values and they are always smaller than the size of the symbol. The dashed line corresponds to values of $\Gamma$ that were calculated using the molecular volumes of each protein from Table 1.


● CPh3 △ CHPh2 ■ CH2Ph
10^4
10^3
10^2
10
Γ (ng/cm²)
10
10²
10³
Molecular Volume (nm³)