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1,3-Diphenylpropane-1,3-diamines XII [1]. A Novel Approach to Stereodefined Oximes and Oxime Ethers of Monothioketalized 1,3-Diketones and their Conversion to 3-Aminooximes[a]

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Summary. Mono-O,O- and mono-S,S-ketals of 1,3-diphenylpropane-1,3-diones react with hydroxylamine hydrochloride and O-methylhydroxylamine hydrochloride affording mixtures of (*E*/*Z*) isomers which are hard to separate or are even unseparable. Isomerically pure oximes and O-methyloximes, however, are obtained either from 2-lithiated 1,3-dithianes and α-halogeno-oximes and α-halogeno-oxime ethers, resp., or from lithiated oxime ethers and dithienium salts. Reduction, acetylation, hydrolysis of the ketal increment, and oximation afford 3-amino-oximes which are precursors of 1,3-diphenylpropane-1,3-diamines.

Keywords. 1,3-Diphenylpropane-1,3-diamines; Monoketalized 1,3-diones; Lithiated 1,3-dithianes; α-Halogeno-oximes; α-Halogeno-oxime ethers; Dithienium salts; Lithiated oxime ethers.

1,3-Diphenylpropan-1,3-diamine, 12. Mitt. [1]**. Ein neuer Zugang zu stereochemisch einheitlichen Oximen und Oximethern von monothioketalisierten 1,3-Diketonen und ihre Umsetzung zu 3-Aminooximen**

Zusammenfassung. Mono-O,O- und Mono-S,S-ketale von 1,3-Diphenylpropan-1,3-dionen liefern mit Hydroxylaminhydrochlorid bzw. O-Methylhydroxylaminhydrochlorid (*E*/*Z*)-Gemische der Oxime bzw. der O-Methyloxime, die sich nur schwer oder überhaupt nicht trennen lassen. Andererseits sind isomerenreine Oxime bzw. O-Methyloxime durch Umsetzung von 2-lithiierten 1,3-Dithianen mit α-Halogenoximen und ihren O-Methylethern oder durch Reaktion von lithiierten Oximethern mit Dithieniumsalzen zugänglich. Reduktion, Acetylierung, Ketalspaltung und Oximbildung führen dann zu 3-Aminooximen. Diese Verbindungen sind Vorstufen für 1,3-Diphenylpropan-1,3-diamine.

[a] Dedicated with warm regards to Prof. Dr. *G. Heinisch*, Innsbruck, on the occasion of his 60th birthday

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Introduction

In part IX of this series [2] we have described the reaction of α-lithiobenzylamines with an α-halogeno-oxime ether affording 3-aminopropan-1-one oxime ethers. Here we report on the synthesis of stereodefined oximes and their pertinent O-methyl ethers of 1,3-diketones, obtained from 2-lithiated 1,3-dithianes and α-halogeno-oximes and their O-methyl- and O-silyl derivatives.

Results and Discussion

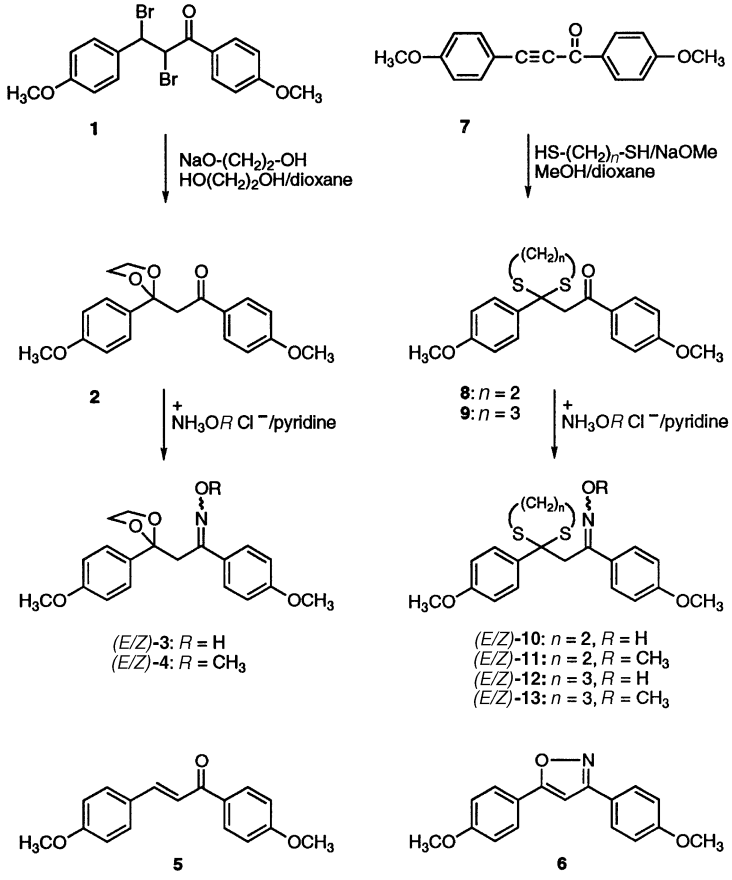
1,3-Diones, their mono-O,O- and mono-S,S-ketals, and their oximes and oxime ethers

The starting point of our synthesis of monoketal **2** (Scheme 1) was the formation of a dimethyl ketal from a 2,3-dibromopropan-1-one with KOH/MeOH as described in 1904 by *Wieland* [3]. To the best of our knowledge this is the only report on this conversion. A forthcoming paper will be concerned with this reaction.

In sharp contrast to the preparation of the dioxolane derivative **2**, we could not prepare the dithiolane **8** and the dithiane **9**, resp., when reacting the dibromopropanone **1** with pertinent alkanedithioles: Although we used various basic catalysts, we always obtained high yields of *bis*(4-methoxyphenyl)-2-propen-1-one (**5**). Dehalogenations of α,β-dibromo compounds with thioles and Na_2S, respectively, are known [4, 5]. A variety of methods has been described for the synthesis of monoketals of 1,3-diones [6–9]. In our hands, only the twofold *Michael*-analogous addition of dithioles [8, 9] to propinone **7** was successful.

Due to the lability of the dioxolane increment, oximation of ketal **2** was difficult. Besides the expected instability in acidic media, the dioxolane ring was opened also under basic conditions giving rise to 3,5-*bis*(4-methoxyphenyl)isoxazole **6** (Scheme 1), probably following an *E1cB* mechanism. Satisfying results were obtained only in pyridine under strict control of the procedures used for the reaction and for work-up: For the reactions with hydroxylamine hydrochloride without addition of a base, protic solvents turned out to be unsuitable. In water/EtOH with KOH as a base, the yield of oxime **3** was also poor, and the formation of the isoxazole was dominant. Moreover, the crude oxime **3** was a 85:15 (*E*/*Z*) mixture (^{1}H NMR) from which (*Z*)-**3** could be removed by ether and subsequent recrystallization. We tried to obtain pure (*Z*)-**3**, but only an enrichment was possible. The formation of the oxime ether **4** also requires sophisticated handling: column chromatography (CC) of the 75:25 (*E*/*Z*) mixture afforded 41% (*E*)-**4**, 7% (*Z*)-**4**, and 26% of (*E*/*Z*)-**4**.

Due to the higher stability of thioketals as compared to their oxygen analogues [10], no difficulties arose when the dithiolane (**8**) or dithiane derivatives (**9**) were converted to the pertinent oximes. With hydroxylamine hydrochloride as well as with its O-methyl ether, the corresponding oximes **10** and **12** or the oxime ethers **11** and **13** were obtained as (*E*/*Z*) mixtures. For the dithiane derivatives **12** and **13**, the intensity of the C-2 methylene protons (^{1}H NMR) revealed (*E*/*Z*) ratios of 70:30 and 60:40, resp. For the dithiolanes **10** and **11**, the (*E*/*Z*) ratio could not be determined by ^{1}H NMR spectroscopy, because the N-methoxy signal of **11**



Scheme 1

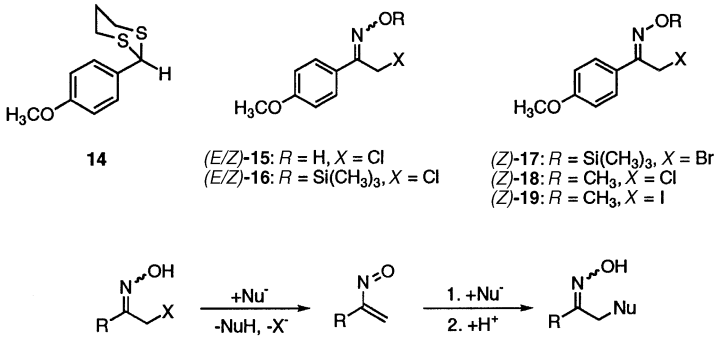
overlaps with those of the anisole increments, and the S-CH_2 groups interfere with C-2 methylene protons.

The (*E*/*Z*) isomers of the oxime ethers **11** and **13** could not be separated. For the reduction with chiral borane complexes according to *Sakito et al.* [11], however, stereochemically homogeneous educts are required. These authors obtained enantiomerically pure amines by reduction of the (*E*)- and (*Z*)-stereomers of O-methyloximes, using the same enantiomerically pure reducing agent. Therefore, we established a synthesis of diastereomerically pure oxime derivatives of monothioketalized 1,3-diketones.

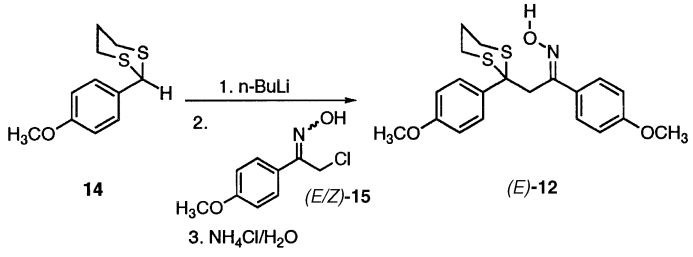
Diastereomerically pure oxime derivatives of 2-(2-(4-methoxyphenyl)-1,3-dithian-2-yl)-1-(4-methoxyphenyl)ethanone (**9**) *from a 2-lithio-1,3-dithiane and* α*-halogeno-oxime derivatives*

a) Oximes

We examined the reaction of the lithiated dithiane **14** with oxime **15** and oxime ethers **16–19** (Scheme 2). According to Ref. [12], substitution of α-halogeno-



Scheme 2



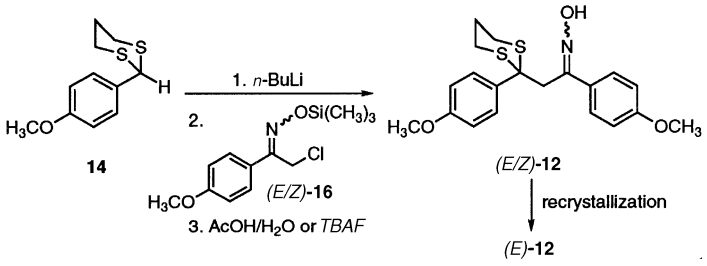
Scheme 3

oximes with strongly basic nucleophiles follows an elimination-addition mechanism: 1,4-Elimination leads to a nitrosoalkene which is attacked by a second equivalent of the nucleophile in a *Michael*-analogous manner. Here, two disadvantages come up: loss of one equivalent of the nucleophile and the separation of non-reacted nucleophile, which is probably difficult.

In spite of these drawbacks we reacted the diastereomeric mixture (*E*/*Z*)-**15** with lithiated dithiane **14**, because we were interested in the stereochemical result of this procedure. α-Halogeno-oximes may react with nucleophiles either by inversion [13, 14] or possibly by retention [15, 16] of the oxime geometry. In our hands, the reaction led exclusively to (*E*)-**12**, as indicated by the ^{1}H NMR spectrum of the crude product, but the excess of dithiane **14** could not be removed by crystallization, because compounds **12** and **14** behaved similarly under the conditions of recrystallization, and the low solubility of the condensation product **12** impeded purification by CC. Because we expected to obtain (*E*)-**12** by another route (see below), we did not follow this procedure any longer.

The conversion of lithiated dithiane **14** with (*E*/*Z*)-α-chloro-O-silyloxime (*E*/*Z*)-**16** and subsequent *in situ* desilylation with AcOH/H_2O [17] or tetrabutylammonium fluoride (*TBAF*) [18], resp., led to an (*E*/*Z*) mixture of oxime **12** in 80 and 65% yield, resp. Threefold recrystallization afforded 49% of diastereomerically pure (*E*)-**12**.

Use of isomerically pure (*Z*)-α-bromo-O-silyloxime (*Z*)-**17** was of no benefit as compared to the reaction of **14** with (*E*/*Z*)-**16**, because desilylation with AcOH/H_2O led partially to isomerization; this could be avoided using *TBAF*. However, the



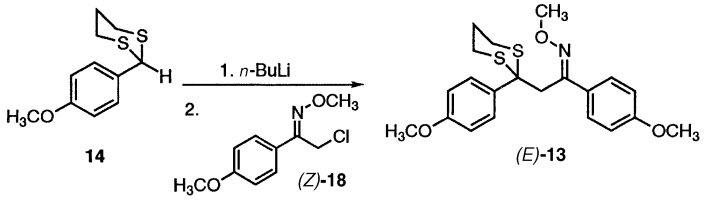
Scheme 4

crude products in both versions were contaminated by 1,4-*bis*(4-methoxyphenyl)-1,4-butanedione dioxime (**21a**) (Scheme 6). Separation of **21a** led to heavy losses of isomerically pure (*E*)-**12**; therefore, this procedure had no favourable effect when compared with the reaction of (*E*/*Z*)-**16**.

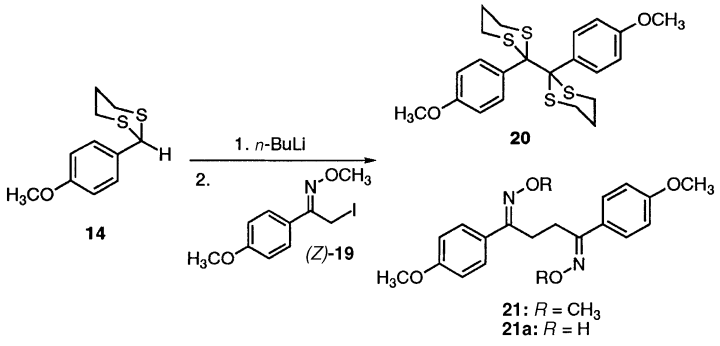
b) Oxime ethers

Reaction of (*Z*)-α-chloro-oxime ether (*Z*)-**18**, however, led to the desired ketalized oxime ether (*E*)-**13** in 80% yield after recrystallization. (*E*/*Z*)-**18** yielded 85% of (*E*/*Z*)-**13** after CC purification.

(*Z*)-α-Iodo-oxime ether (*Z*)-**19**, however, is unsuitable: According to its ^{1}H NMR spectrum, the crude product contained less than 10% of (*E*)-**13**; the main quantity consisted of the dimerization products **20** and **21**. Dimerization of 2-lithiated dithianes under the conditions of electrophilic reactions is known [10, 19, 20].



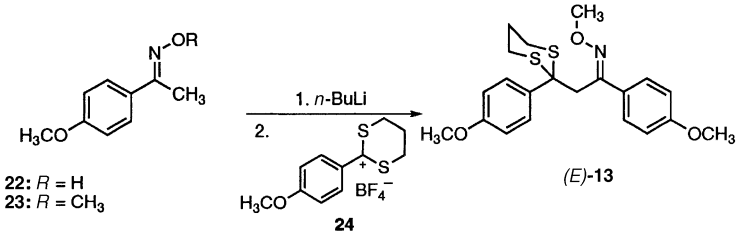
Scheme 5



Scheme 6

Reaction of 1,3-dithienium salts and lithiated oxime ethers

The reaction of C-lithiated oximes and oxime ethers, resp., with 1,3-dithienium salts offers a further possibility for the synthesis of isomerically pure oxime derivatives of monothioketalized 1,3-diketones. The twofold lithiated oxime **22** did not react with the dithienium salt **24** as expected: (*E*)-**12** could not be detected in the reaction mixture. The (mono) lithiated oxime ether **23**, however, afforded (*E*)-**13** in 40% yield.

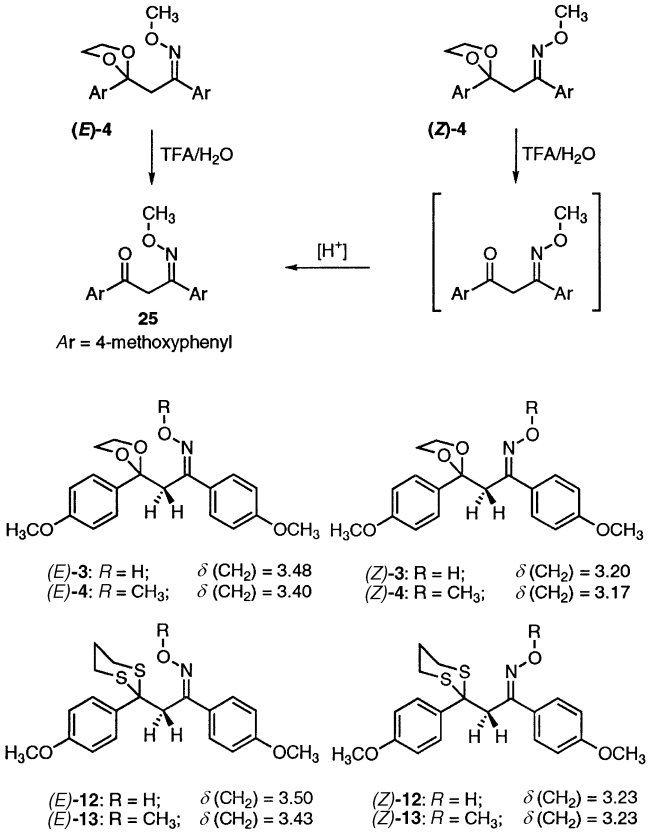


Scheme 7

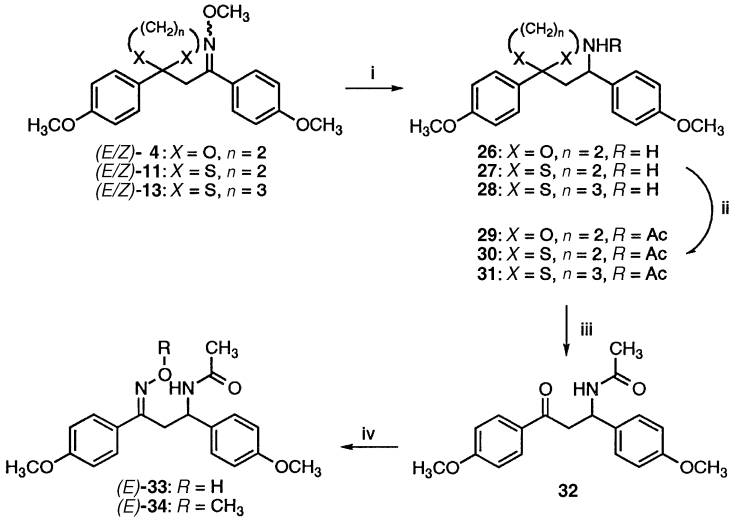
Assignment of oxime geometries

According to *Karabatsos* (21), (*E*)- and (*Z*)-O-methyloximes can be differentiated by the chemical shifts of the methoxyimino increments in their ^{1}H NMR spectra. They show a difference of 0.16–0.18 ppm; the isomer with its O-methyl group *anti* to the aromatic ring resonates at lower field strength than the diastereomer with *syn* position. For our oxime ethers (*E*)-**4** and (*Z*)-**4**, however, these assignments are impossible, because the methoxyimino moieties absorb near the resonances of the anisole increments. Assignment after hydrolysis of the dioxolane ring to a 3-methoxyimino-propanone and comparison with authentic (*E*)-3-methoxyimino-propanone **25** also failed (Scheme 8). Both isomers of the oxime ether **4** afforded the (*E*)-3-methoxyimino-propanone **25**. Under the hydrolytic conditions [22] used (*Z*)-**4** obviously isomerizes to (*E*)-**4**, either at the dioxolane status or as the corresponding oxime ether ketone. Finally, the stereochemistry of the isomeric oximes **3** and the oxime ethers **4** was established by comparison with the oxime derivatives **12** and **13** the stereochemistry of which had been ascertained by independent ways: Reaction of dithiane **14** with the bromo compound (*Z*)-**17** afforded (*E*)-**12** (cf. also Scheme 5). The isomers of **3** and **4**, resp., as well as the isomers of **12** and **13** exhibit different chemical shifts of their C-2 methylene increment. In the (*E*)-isomers of **12** and **13** the resonances of this CH_2-moiety are shifted downfield as compared with those of the (*Z*)-isomers. Therefore, we assign (*E*)-configuration to those diastereomers of **3** and **4** with more downfield chemical shifts.

The chemical shift value of 3.63 ppm for the methoxyimino group in (*E*)-**13** is peculiar. Comparison with the ^{1}H NMR spectrum of (*E*/*Z*)-**13** indicates that the (*Z*)-isomer resonates downfield in the region of the aromatic methoxy groups. In this case, assignment according to *Karabatsos* [21] would have led to the wrong result.



Scheme 8



Reagents and conditions: (i) BH_3–*THF*; (ii) Ac_2O/pyridine; (iii) *TFA*/EtOH/H_2O for **29**; chloramine T/MeOH/H_2O for **30** and **31**; (iv) $^+NH_3OR\ Cl^-$/pyridine

Scheme 9

Conversion of oxime ethers to 3-amino-oxime derivatives

The oxime ethers **4**, **11**, and **13** were reduced by borane-*THF* [23] producing the amines **26**, **27**, and **28** in 35%, 86%, and 85% yield. These ketalized amines could not be converted to 1,3-*bis*(4-methoxyphenyl)-3-aminopropan-1-one. Hydrolysis of the dioxolane **26** afforded 1,3-*bis*(4-methoxyphenyl)-2-propen-1-one (**5**; Scheme 1), treatment of the thioketals **27** and **28** with chloramine T (N-chlorotoluene-sulfonamide sodium salt) [24] in $MeOH/H_2O$ gave useless mixtures, probably due to the well known sensitivity of 1,3-diphenyl-3-aminopropan-1-ones [25]. After N-acetylation to the amides **29–31**, the ketals could be cleaved, affording the 3-acetamidopropanone **32**. This amide was converted to the oxime **33** and the oxime ether **34** in isomerically pure status; both of them show (*E*)-configuration as established by comparison with the ^1H NMR spectra of known (*E*)-3-acylamino-oxime ethers [26].

Experimental

General remarks: see Ref. [2]. CC was performed on silica gel. Compounds **1** [27], **14** [10], (*E*/*Z*)-**15** [28], (*Z*)-**18**, (*Z*)-**19** [2], **22**, **23** [26], and **24** [7] were prepared according to the pertinent procedures. Compound **7** was synthesized according to Ref. [29] by reaction of 4-methoxyphenylethine with the corresponding benzaldehyde, using the Li-acetylide instead of the Mg-acetylide and *PDC*/*DMF* instead of CrO_3/H_2SO_4 for subsequent oxidation of the secondary carbinol to the ketone.

2-(2-(4-Methoxyphenyl)-1,3-dioxolan-2-yl)-1-(4-methoxyphenyl)ethanone (**2**)

To a solution of 2.0 g (87 mmol) of Na in 60 ml of dry ethylene glycol, 20 ml of dry dioxane are added. The flask is placed in oil bath (50–60°C), and a solution of 8.56 g (20 mmol) of **1** in 50 ml of dry dioxane is added. The temperature is raised to 100°C within 1 h, and stirring is continued for 1 h at this temperature. After cooling, dioxane is removed *in vacuo*, and the mixture is extracted with Et_2O (3×100 ml). The combined Et_2O layers are washed with H_2O (2×50 ml) and brine (2×40 ml), dried, and evaporated. CC (gradient from CH_2Cl_2/EtOAc 9.5/0.5 to 9/1) affords **2** as a pale yellow oil which crystallizes upon drying at the oil pump.

Yield: 3.81 g (58%); m.p.: 66–68 °C; IR (Kbr): $\nu = 1665$ (C = O) cm^{-1}; ^1H NMR ($CDCl_3$): $\delta = 3.52$ (s, 2H, CH_2), 3.63–4.00 (m, 4H, OCH_2CH_2O, partially overlapped by OCH_3), 3.77 (s, 3H, OCH_3), 3.85 (s, 3H, OCH_3), 6.77–7.00 (m, 4H, arom), 7.37–7.57 (m, 2H, arom), 7.85–8.07 (m, 2H, arom) ppm; $C_{19}H_{20}O_5$ (328.4); calcd.: C 69.50, H 6.14; found: C 69.31, H 6.25.

2-(2-(4-Methoxyphenyl)-1,3-dithiolan-2-yl)-1-(4-methoxyphenyl)ethanone (**8**)

To a solution of 1.15 g (50 mmol) of Na in 40 ml of dry MeOH, a solution of 1.8 g (19 mmol) of 1,2-ethanedithiol in 10 ml of dry MeOH and a solution of 3.33 g (12.5 mmol) of **7** in 30 ml of dry dioxan are added successively at 0°C under N_2 within 5 min. After stirring for 1.5 h at 0°C, the mixture is poured into 350 ml of H_2O and extracted with EtOAc (1×100 ml and 4×50 ml). The combined organic layers are washed with 2 *N* NaOH (2×50 ml) und brine (2× 50 ml), dried, and evaporated. CC (Et_2O/PE 7/3; for application onto the silica, the residue is taken up in CH_2Cl_2) affords **8** as a colourless oil.

Yield: 4.24 g (94%); IR (film): $\nu = 1680$ (C=O) cm^{-1}; ^1H NMR ($CDCl_3$): $\delta = 3.30$ (s, 4H, SCH_2CH_2S), 3.72 (s, 3H, OCH_3), 3.83 (s, 3H, OCH_3), 4.20 (s, 2H, CH_2), 6.70–7.00 (m, 4H, arom), 7.57–8.00 (m, 4H, arom) ppm; $C_{19}H_{20}O_3S_2$ (360.5); calcd.: C 63.30, H 5.59; found: C 63.15, H 5.61.

2-(2-(4-Methoxyphenyl)-1,3-dithian-2-yl)-1-(4-methoxyphenyl)ethanone (**9**)

Preparation according to the procedure given for **8** with 2.1 g (19 mmol) of 1,3-propanedithiol, purification as described for **8**. The combined fractions are concentrated until crystallization starts, left at 4°C, and sucked off; colourless crystals, yield: 1.68 g (36%). Evaporation of the mother liquor gives 1.17 g (25%) as a pure oil which, however, could not be crystallized.

M.p.: 90°C; IR (KBr): $\nu = 1663$ (C=O) cm^{-1}; ^1H NMR ($CDCl_3$): $\delta = 1.77–2.10$ (m, 2H, $SCH_2CH_2CH_2S$), 2.53–2.83 (m, 4H, $SCH_2CH_2CH_2S$), 3.58 (s, 2H, CH_2), 3.77 (s, 3H, OCH_3), 3.83 (s, 3H, OCH_3), 6.70–6.93 (m, 4H, arom), 7.67–7.97 (m, 4H, arom) ppm; $C_{20}H_{22}O_3S_2$ (374.5); calcd.: C 64.14, H 5.92; found: C 64.13, H 5.92.

(E)-2-(2-(4-Methoxyphenyl)-1,3-dioxolan-2-yl)-1-(4-methoxyphenyl)ethanone oxime (*E*)-(**3**)

At room temperature, 5.73 g (17.45 mmol) of **2** and 2.42 g (34.9 mmol) of hydroxylammonium chloride are stirred in 30 ml of pyridine for 14 h. The mixture is poured into 500 ml of ice-cold 2 *N* HCl and immediately extracted with 250 ml of EtOAc; the extract is instantly washed with satd. $NaHCO_3$ solution (200 ml) and brine (2×50 ml), dried, and evaporated. The yellow residue (4.72 g (*E*/*Z*) mixture) is stirred with 20 ml of Et_2O for 1 h, sucked off, and recrystallized twice from 14 and 12 ml of benzene, resp., to afford (*E*)-**3** as colourless crystals.

Yield: 2.93 g (49%); m.p.: 146–148°C; IR (KBr): $\nu = 3300–3000$ (OH), 1607 (C=N and C=C) cm^{-1}; ^1H NMR ($CDCl_3$): $\delta = 3.48$ (s, 2H, CH_2), 3.63–3.91 (m, 10H, OCH_2CH_2O and 2 OCH_3), 6.71–6.97 (m, 4H, arom), 7.31–7.73 (m, 4H, arom), 8.26 (s, br, 1H, OH, exch.) ppm; $C_{19}H_{21}NO_5$ (343.4); calcd.: C 66.46, H 6.16, N 4.08; found: C 66.10, H 5.94, N 4.21.

(E)- and (Z)-2-(2-(4-Methoxyphenyl)-1,3-dioxolan-2-yl)-1-(4-methoxyphenyl)ethanone O-methyloxime ((*E*)-**4** *and* (*Z*)-**4**)

At room temperature, 3.28 g (10 mmol) of **2** and 1.0 g (12 mmol) of O-methylhydroxylammonium chloride are stirred in 15 ml of pyridine for 16 h. The mixture is poured into 250 ml of ice-cold dil. HCl (from 150 ml 2 *N* HCl and 100 g ice) and immediately extracted with Et_2O (250 ml); the Et_2O layer is instantly washed with satd. $NaHCO_3$ solution (200 ml) and brine (2×70 ml), dried, and concentrated. The diastereomers are separated by CC (Et_2O/*PE* 1/1). In addition to 0.95 g (26%) of (*E*/*Z*) mixture, there are obtained:

(*E*)-**4**: Pale yellow oil which solidifies upon storage; yield: 1.47 g (41%); recrystallization from 14 ml of 2-propanol (tends to separate as an oil, addition of seed crystals recommended) affords colourless crystals.

Yield: 1.06 g (29%); m.p.: 61–62°C; IR (KBr): $\nu = 1609$ (C=N and C=C) cm^{-1}; ^1H NMR ($CDCl_3$): $\delta = 3.40$ (s, 2H, CH_2), 3.57–3.87 (m, 13H, OCH_2CH_2O and 3 OCH_3), 6.68–6.93 (m, 4H, arom), 7.23–7.43 (m, 2H, arom), 7.50–7.70 (m, 2H, arom) ppm; $C_{20}H_{23}NO_5$ (357.4); calcd.: C 67.21, H 6.49, N 3.92; found: C 66.89, H 6.65, N 4.06.

(*Z*)-**4**: Colourless crystals; yield: 0.24 g (7%); recrystallization from 0.8 ml of MeOH provides colourless crystals.

Yield: 0.22 g (6%); m.p.: 93–94°C; IR (KBr): $\nu = 1613$ (C=N and C=C) cm^{-1}; ^1H NMR ($CDCl_3$): $\delta = 3.17$ (s, 2H, CH_2), 3.60–3.87 (m, 13H, OCH_2CH_2O and 3 OCH_3), 6.70–6.97 (m, 4H, arom), 7.23–747 (m, 4H, arom) ppm; $C_{20}H_{23}NO_5$ (357.4); calcd.: C 67.21, H 6.49, N 3.92; found: C 67.02, H 6.40, N 3.89.

(E/Z)-2-(2-(4-Methoxyphenyl)-1,3-dithiolan-2-yl)-1-(4-methoxyphenyl)ethanone oxime ((*E/Z*)-**10**)

1.80 g (5 mmol) of **8** and 1.39 g (20 mmol) of hydroxylammonium chloride are stirred in 5 ml of pyridine at 80 °C for 5 h. Pyridine is removed *in vacuo*; the residue is mixed with 20 ml of 2 *N* HCl

and extracted with EtOAc (3×50 ml). The combined org. layers are washed with satd. $NaHCO_3$ solution (2× 30 ml) and brine (2× 30 ml), dried, and evaporated to give a solid. Recrystallization from EtOH affords (*E*/*Z*)-**10** as colourless crystals.

Yield: 1.51 g (80%); melting range: 129–136°C; IR (KBr): $\nu = 3234$ (OH), 1605 (C=N and C=C) cm^{-1}; ^1H NMR ($CDCl_3$): $\delta =$ 2.87–3.37 (m, 4H, 2 CH_2), 3.57–3.90 (m, 8H, CH_2 and 2 OCH_3), 6.53–6.83 (m, 4H, arom), 7.03–7.57 (m, 4H, arom), 8.40 (s, br, 1H, OH, exch.) ppm; $C_{19}H_{21}NO_3S_2$ (375.5); calcd.: C 60.77, H 5.64, N 3.73; found: C 60.55, H 5.79, N 3.72.

(E/Z)-2-(4-Methoxyphenyl)-1-,3-dithiolan-2-yl)-1-(4-methoxyphenyl)ethanone O-methyloxime ((*E*/*Z*)-**11**)

The procedure described for (*E*/*Z*)-**10** is used with 0.84 g (10 mmol) of O-methylhydroxylammonium chloride instead of hydroxylammonium chloride. CC (Et_2O/PE 1/1; for application onto the silica, the residue is taken up in CH_2Cl_2) provides (*E*/*Z*)-**11** as a colourless oil.

Yield: 1.65 g (85%); IR (film): $\nu = 1609$ (C=N and C=C) cm^{-1}; ^1H NMR ($CDCl_3$): $\delta = 2.90$–3.33 (m, 4H, 2 CH_2), 3.58–3.83 (m, 11H, CH_2 and 3 OCH_3), 6.58–7.63 (m, 8H, arom) ppm; $C_{20}H_{23}NO_3S_2$ (389.5); calcd.: C 61.67, H 5.95, N 3.60; found: C 61.63, H 6.00, N 3.63.

(E/Z)-2-(2-(4-Methoxyphenyl)-1-,3-dithian-2-yl)-1-(4-methoxyphenyl)ethanone oxime ((*E*/*Z*)-**12**)

The procedure described for (*E*/*Z*)-**10** is used with 1.87 g (5 mmol) of **9** instead of **8**. Recrystallization from $CHCl_3$ gives (*E*/*Z*)-**12** as colourless crystals.

Yield: 1.44 g (74%); melting range: 130–135°C; IR (KBr): $\nu = 3228$ (OH), 1605 (C=N and C=C) cm^{-1}; ^1H NMR ($CDCl_3$): $\delta = 1.67$–2.00 (m, 2H, $SCH_2CH_2CH_2S$), 2.47–2.73 (m, 4H, $SCH_2CH_2CH_2S$), 3.23 and 3.50 (2s, 2H, CH_2 (*Z*) and (*E*) isomer), 3.75 (s, 6H, 2 OCH_3), 6.53–6.80 (m, 4H, arom), 7.07–7.28 (m, 2H, arom), 7.50–7.75 (m, 2H, arom), 8.17 (s, br; 1H, OH, exch.) ppm; $C_{20}H_{23}NO_3S_2$ (389.5); calcd.: C 61.67, H 5.95, N 3.60; found: C 61.29; H 5.80, N 3.46.

(E/Z)-2-(2-(4-Methoxyphenyl)-1,3-dithian-2-yl)-1-(4-methoxyphenyl)ethanone O-methyloxime ((*E*/*Z*)-**13**)

Prepared according to the protocol given for (*E*/*Z*)-**11** with 1.87 g (5 mmol) of **9** instead of **8**: colourless oil.

Yield: 1.82 g (90%); IR (film): $\nu = 1607$ (C=N and C=C) cm^{-1}; ^1H NMR ($CDCl_3$): $\delta = 1.67$–2.00 (m, 2H, $SCH_2CH_2CH_2S$), 2.40–2.70 (m, 4H, $SCH_2CH_2CH_2S$), 3.23 and 3.43 (2s, 2H, CH_2 (*Z*) and (*E*) isomer), 3.63 and 3.83 (2s, 3H, $NOCH_3$ (*E*) isomer, $NOCH_3$ (*Z*) isomer together with 6H of 2 C–OCH_3), 6.57–6.82 (m, 4H, arom), 7.02–7.37 (m, 2H, arom), 7.48–7.77 (m, 2H, arom) ppm; $C_{21}H_{25}NO_3S_2$ (403.6); calcd.: C 62.50, H 6.24, N 3.47; found: C 62.39, H 6.13, N 3.77.

Reaction of C-2-lithiated 2-(4-methoxyphenyl)-1,3-dithiane (**14**) *with (E/Z)-2-chloro-1-(4-methoxyphenyl)ethanone oxime* ((*E*/*Z*)-**15**)

Under N_2, 3.5 ml of a 1.6 *M* solution of *n*-BuLi in hexane are added to a solution of 1.13 g (5 mmol) of **14** in 25 ml of dry *THF* at −78°C. After stirring for 1 h at −78°C, a solution of 0.40 g (2 mmol) of (*E*/*Z*)-**15** in 5 ml of dry *THF* is added. After 20 min of stirring at −78°C, 5 ml of half-satd. NH_4Cl solution are added, the organic phase is separated, and the aqueous layer is extracted with EtOAc (15 ml). The combined organic phases are washed with brine (2×5 ml), dried, and evaporated to give a pale yellow solid; yield 1.20 g, mixture of **14** and (*E*)-**12** (^1H NMR).

(E/Z)-2-Chloro-1-(4-methoxyphenyl)ethanone O-(trimethylsilyl)oxime ((*E/Z*)-**16**)

At 0°C, a solution of 2.63 g (26 mmol) of Et_3N in 15 ml of dry benzene and a solution of 2.83 g (26 mmol) of chlorotrimethylsilane in 15 ml of dry benzene are added simultaneously dropwise to a solution of 5.0 g (25 mmol) of (*E/Z*)-**15** in 65 ml of dry benzene under N_2. After addition, stirring is continued for 2 h at 0°C, for 1 h at reflux, and for 20 min at 0°C. The mixture is sucked off, the filter cake is washed with dry benzene (2×20 ml), and the combined filtrates are evaporated. *Kugelrohr* distillation (7×10^{-5} torr, oven temp. 140°C) affords (*E/Z*)-**16** as a colourless oil.

Yield: 3.85 g (57%); IR (film): $\nu = 1611$ (C=N and C=C) cm^{-1}; ^1H NMR ($CDCl_3$): $\delta = 0.30$ (s, 9H, $Si(CH_3)_3$), 3.83 (s, 3H, OCH_3), 4.50 and 4.62 (2s, 2H, CH_2 (*E*) and (*Z*) isomer), 6.98, 7.73 (AA′ BB′, $J_{AB} = 9$ Hz, 4H, arom) ppm; $C_{12}H_{18}ClNO_2Si$ (271.8); calcd.: C 53.02, H 6.67, N 5.15; found: C 53.16, H 6.62, N 5.30.

(Z)-2-Bromo-1-(4-methoxyphenyl)ethanone O-(trimethylsilyl)oxime ((*Z*)-**17**)

At 0°C, 2.73 g (27 mmol) of Et_3N and 4.13 (27 mmol) of bromotrimethylsilane, each dissolved in 10 ml of dry benzene, are added simultaneously dropwise to a solution of 3.66 g (15 mmol) of (*Z*)-2-bromo-1-(4-methoxyphenyl)ethanone oxime [30] in 50 ml of dry benzene under N_2. The resulting mixture is stirred for 1 h at 0°C and for 2 h at 50°C. After further 20 min at 0°C, the mixture is sucked off, and the filter cake is washed with dry benzene (2 × 20 ml). The combined filtrates are evaporated and dried at the oil pump. 50 ml of *PE* are added, the gummy residue is kneaded with a glass rod, and the *PE* is decanted. This procedure is repeated twice with 25 ml of *PE* each. Evaporation of the combined *PE* solutions and *Kugelrohr* distillation (7×10^{-5} torr, oven temp. 150°C) gives (*Z*)-**17** as a pale yellow oil.

Yield: 3.30 g (69%); IR (film): $\nu = 1622$ (C=N and C=C) cm^{-1}; ^1H NMR ($CDCl_3$): $\delta = 0.30$ (s, 9H, $Si(CH_3)_3$), 3.80 (s, 3H, OCH_3), 4.40 (s, 2H, CH_2), 6.93, 7.73 (AA′BB′, $J_{AB} = 9$ Hz, 4H, arom) ppm; $C_{12}H_{18}BrNO_2Si$ (316.3); C 45.57, H 5.74, N 4.43; found: C 45.40, H 5.56, N 4.41.

(E)-2-(2-(4-Methoxyphenyl)-1,3-dithian-2-yl)-1-(4-methoxyphenyl)ethanone oxime ((*E*)-**12**)

To a solution of lithiated **14** (5 mmol), prepared as described for the reaction of (*E/Z*)-**15**, a solution of 1.36 g (5 mmol) of (*E/Z*)-**16** in 5 ml of dry *THF* is added at −78°C. After 30 min of stirring at −78 °C, the cooling bath is removed; stirring is continued for 20 min. 10 ml of AcOH and 5 ml of H_2O are added, and stirring is continued overnight. The mixture is alkalized by addition of 15 g solid anhydrous Na_2CO_3 in small quantities and extracted with EtOAc (3×50 ml). The combined EtOAc layers are washed with satd. $NaHCO_3$ solution (30 ml) and brine (2×30 ml), dried, and evaporated. Recrystallization from 15 ml of $CHCl_3$ provides (*E/Z*)-**12** as colourless crystals; yield: 1.56 g (80%). Three further recrystallizations from $CHCl_3$ afford isomerically pure (*E*)-**12** as colourless crystals.

Yield: 0.96 g (49%); m.p.: 156°C; IR (KBr): $\nu = 3228$ (OH), 1605 (C=N and C=C) cm^{-1}; ^1H NMR ($CDCl_3$): $\delta = 1.67$–2.00 (m, 2H, $SCH_2CH_2CH_2S$), 2.47–2.73 (m, 4H, $SCH_2CH_2CH_2S$), 3.50 (s, 2H, CH_2), 3.75 (s, 3H, OCH_3), 3.78 (s, 3H, OCH_3), 6.60–6.85 (m, 4H, arom), 7.13–7.33 (m, 2H, arom), 7.60–7.80 (m, 2H, arom), 7.90 (s, 1H, OH, exch.) ppm; $C_{20}H_{23}NO_3S_2$ (389.5); calcd.: C 61.67, H 5.95, N 3.60; found: C 61.87; H 6.00, N 3.56.

Reaction of lithiated **14** *with (Z)-***17** */ Desilylation with AcOH/H₂O affording* (*E/Z*)-**12**

Instead of (*E/Z*)-**16**, a solution of 1.60 g (5 mmol) of (*Z*)-**17** in 5 ml of dry *THF* is added to a solution of lithiated **14** (5 mmol). The crude product is boiled with 5 ml of $CHCl_3$ and sucked off while hot. The filtrate is left at 4°C for crystallization, and the crystals are filtered off. This procedure is repeated with 8 ml of $CHCl_3$ to give (*E/Z*)-**12** as colourless crystals. Yield: 1.03 g (53%).

The filter cake of the above $CHCl_3$ extractions consists of dioxime **21a**: colourless crystals, yield: 0.23 g; for analytical data, see Ref. [26].

Reaction of lithiated **14** *with* (*E*/*Z*)-**16** */ Desilylation with TBAF affording* (*E*/*Z*)-**12**

Instead of ($AcOH/H_2O$ [17], a solution of 4.73 g (15 mmol) *TBAF* · $3H_2O$ [18] in 20 ml of *THF* is added. After 45 min, 10 ml of satd. NH_4Cl solution are added; the org. layer is separated, and the aqueous layer is extracted with EtOAc (2×20 ml). The combined org. phases are washed with brine (2×10 ml), dried, and evaporated. After drying at the oil pump, the oily residue is dissolved in 7 ml of MeOH and left for 1 h for crystallization. Recrystallization from 10 ml of $CHCl_3$ affords (*E*/*Z*)-**12** as colourless crystals. Yield: 1.26 g (65%), data: see above.

Reaction of lithiated **14** *with* (*Z*)-**17** */ Desilylation with TBAF* affording (*E*)-**12**

The procedures described above are used, affording stereochemically pure (*E*)-**12**; yield: 1.0 g (51%).

(E)-2-(2-(4-Methoxyphenyl)-1,3-dithian-2-yl)-1-(4-methoxyphenyl)ethanone O-methyloxime ((*E*)-**13**)

At −78°C, a solution of 1.07 g (5 mmol) of (*Z*)-**18** in 5 ml of dry *THF* is added to a solution of lithiated **14** (5 mmol) prepared as described above. After 2 h of stirring at −78°C, the reaction is terminated by addition of 6 ml of half-satd. NH_4Cl solution; the org. layer is separated, and the aqueous layer is extracted with Et_2O (2 × 20 ml). The combined org. phases are washed with brine (2 × 8 ml), dried, and evaporated to give a yellow oil which crystallizes upon drying at the oil pump. Recrystallization from 30 ml of MeOH (tends to separate as an oil, addition of seed crystals recommended; crystallization first at room temp., then at 4°C) affords (*E*)-**13** as colourless crystals.

Yield: 1.61 g (80%); m.p.: 92°C; IR (KBr): $\nu = 1607$ (C=N and C=C) cm^{-1}; ^1H NMR ($CDCl_3$): $\delta = 1.67$–2.00 (m, 2H, $SCH_2CH_2CH_2S$), 2.40–2.70 (m, 4H, $SCH_2CH_2CH_2S$), 3.43 (s, 2H, CH_2), 3.63 (s, 3H, $NOCH_3$), 3.77 (s, 6H, 2 OCH_3), 6.63–6.83 (m, 4H, arom), 7.20–7.40 (m, 2H, arom), 7.63–7.80 (m, 2H, arom) ppm; $C_{21}H_{25}NO_3S_2$ (403.6); calcd.: C 62.50, H 6.24, N 3.47; found: C 62.68, H 6.17, N 3.66.

Starting from (*E*/*Z*)-**18**, the crude product is purified by CC (Et_2O/*PE* 2/8) affording (*E*/*Z*)-**12** as a colourless oil; yield: 1.72 g (85%).

2,2′-Bis(4-methoxyphenyl)-2,2′-bi-1,3-dithianyl (**20**) and *(E,E)-1,4-bis(4-methoxyphenyl)-1,4-butandione bis(O-methyloxime)* (**21**)

At −78°C, a solution of 1.53 g (5 mmol) of (*Z*)-**19** in 5 ml of dry *THF* is added to a solution of lithiated **14** (5 mmol). After 1 h of stirring at −78°C, the cooling bath is removed, and stirring is continued for 30 min. 5 ml of half-satd. NH_4Cl solution are added; the org. phase is separated, and the aqueous phase is extracted with EtOAc (2×15 ml). The combined org. layers are washed with brine (2×10 ml), dried, and evaporated to give a yellow solid (2.2 g) containing **20** and **21**.

20: The residue is boiled with 13 ml of EtOH and sucked off while hot. The filter cake is recrystallized from 11 ml of nitromethane to provide **20** as colourless crystals.

Yield: 0.43 g; m.p.: 197–198 °C; IR (KBr): $\nu = 1601$, 1503 (C=C) cm^{-1}; ^1H NMR ($CDCl_3$): $\delta = 1.60$–2.00 (m, 4H, 2 $SCH_2CH_2CH_2S$), 2.28–2.77 (m, 8H, 2 $SCH_2CH_2CH_2S$), 3.80 (s, 6H, 2 OCH_3), 6.67, 738 ($AA'BB'$, $J_{AB} = 9$ Hz, 8H, arom) ppm; $C_{22}H_{26}O_2S_4$ (450.7); calcd.: C 58.63, H 5.82; found: C 58.33, H 5.84.

21: Bisoxime ether **21** crystallizes from the filtrate; colourless crystals, yield: 0.45 g; for analytical data, see Ref. [2].

(E)-2-(2-(4-Methoxyphenyl)-1,3-dithian-2-yl)-1-(4-methoxyphenyl)ethanone O-methyloxime ((*E*)-**13**) *from lithiated 1-(4-methoxyphenyl)ethanone O-methyloxime* (**23**) and *2-(4-methoxyphenyl)-1,3-dithienium tetrafluoroborate* (**24**)

At −78°C, 7.0 ml of a 1.6 *M* solution of *n*-BuLi in hexane are added within 3 min to a solution of 1.79 g (10 mmol) of **23** in 20 ml of dry *THF*. After stirring for 40 min at −78°C, 3.0 g (10.2 mmol) of **24** [7], suspended in 10 ml of dry *THF*, are added. After 45 min of stirring at −78°C, the cooling bath is removed and stirring is continued for 30 min. The reaction is terminated by addition of 4 ml of H_2O; the org. phase is separated, and the aqueous phase is extracted with EtOAc (50 ml). The combined org. phases are washed with brine (2×10 ml), dried, and evaporated. CC (Et_2O/*PE* 1/1) affords a yellow oil which is dissolved in 5 ml of Et_2O. Then, 10 ml of *PE* and seed crystals are added. At 4°C, crystals of (*E*)-**13** separate and are filtered off. Yield: 1.63 g (40%). For analytical data, see above.

Hydrolysis of (*E*)-**4** *and* (*Z*)-**4** *to (E)-3-methoxyimino-1,3-bis(4-methoxyphenyl)-1-propanone* (**25**)

At room temp., a mixture of 0.18 g (0.5 mmol) of (*E*)- or (*Z*)-**4**, 2.5 ml of EtOH, 0.3 ml of H_2O, and 7 drops of CF_3COOH is stirred for 9 h, diluted with 15 ml of EtOAc, dried (K_2CO_3), and evaporated to afford 0.13 g (83%) of **25** as colourless crystals. For analytical data, see Ref. [26].

2-(2-(4-Methoxyphenyl)-1,3-dioxolan-2-yl)-1-(4-methoxyphenyl)ethanamine (**26**)

6.3 g (17.6 mmol) of (*E*/*Z*)-**4** and 53 ml (53 mmol) of a 1 *M* solution of $BH_3 \cdot THF$ in *THF* are heated under reflux for 60 h. After cooling to 0 °C, the excess of $BH_3 \cdot THF$ is carefully destroyed by dropwise addition of 5 ml of H_2O and 50 ml of 3 *N* NaOH. The mixture is refluxed for 15 min; *THF* is evaporated, and the residue is extracted with EtOAc (3× 50 ml). The combined EtOAc phases are washed with brine (2× 30 ml), dried, and evaporated. Purification by CC (CH_2Cl_2/MeOH 9/1) yields **26** as a colourless oil.

Yield: 2.05 g (35%); IR (film): $\nu = 3386$ (NH) cm^{-1}; ^1H NMR ($CDCl_3$): $\delta = 2.07$–2.33 (m, 2H, CH_2), 2.80 (s, 2H, NH_2, exch.), 3.50–4.23 (m, 11H, OCH_2CH_2O, 2 OCH_3 and CH), 6.67–7.50 (m, 8H, arom) ppm; $C_{19}H_{23}NO_4$ (329.4); calcd.: C 69.28, H 7.04, N 4.25; found: C 68.21, H 7.06, N 4.39 (better values for the carbon content could not be obtained).

2-(2-(4-Methoxyphenyl)-1,3-dithiolan-2-yl)-1-(4-methoxyphenyl)ethanamine (**27**)

5.84 g (15 mmol) of (*E*/*Z*)-**11** and 60 ml (60 mmol) of a 1 *M* solution of $BH_3 \cdot THF$ in *THF* are heated under reflux for 60 h. After cooling to 0°C, the excess of $BH_3 \cdot THF$ is carefully destroyed by dropwise addition of 7 ml of H_2O und 6 ml of conc. HCl. The mixture is refluxed for 5 min, cooled, alkalized by addition of 20 ml of H_2O and 10 g of KOH in small amounts, and again refluxed for 10 min. After cooling, the *THF* phase is separated, and the aqueous phase is extracted with 50 ml of *THF*. The combined *THF* phases are washed with brine (2×15 ml), dried, and evaporated. CC (CH_2Cl_2/MeOH 9/1) affords **27** as a colourless oil.

Yield: 4.69 g (86%); IR (film): $\nu = 3370$ (NH) cm^{-1}; ^1H NMR ($CDCl_3$): $\delta = 1.50$ (s, 2H, NH_2, exch.), 2.62–2.77 (m, 2H, CH_2), 3.30–3.47 (m, 4H, SCH_2CH_2S), 3.67–3.87 (m, 1H, CH), 3.73 (s, 3H, OCH_3), 3.78 (s, 3H, OCH_3), 6.67–6.90 (m, 4H, arom), 7.00–7.23 (m, 2H, arom), 7.52–7.73 (m, 2H, arom) ppm; $C_{19}H_{23}NO_2S_2$ (361.5): calcd.: C 63.12, H 6.41, N 3.88; found: C 62.80, H 6.29, N 3.96.

2-(2-(4-Methoxyphenyl)-1,3-dithian-2-yl)-1-(4-methoxyphenyl)ethanamine (**28**)

Starting from 6.05 g (15 mmol) of (*E*/*Z*)-**13**, the procedure given above for **27** affords **28** as a colourless oil.

Yield: 4.80 g (85%); IR (film): $\nu = 3367$ (NH) cm^{-1}; ^1H NMR ($CDCl_3$): $\delta = 1.47$ (s, 2H, NH_2, exch.), 1.73–2.08 (m, 2H, $SCH_2CH_2CH_2S$), 2.37 (d, $J = 6$ Hz, 2H, CH_2), 2.58–2.83 (m, 4H, $SCH_2CH_2CH_2S$), 3.77 (s, 3H, OCH_3), 3.83 (s, 3H, OCH_3), 4.05 (t, $J = 6$ Hz, 1H, CH), 6.73–7.27 (m, 6H, arom), 7.77–7.97 (m, 2H, arom) ppm; $C_{20}H_{25}NO_2S_2$ (375.6); calcd.: C 63.96, H 6.72, N 3.73; found: C 64.05, H 6.69, N. 3.77.

N-(2-(2-(4-Methoxyphenyl)-1,3-dioxolan-2-yl)-1-(4-methoxyphenyl)ethyl)acetamide (**29**)

At room temp., 0.81 g (2.46 mmol) of **26** dissolved in 30 ml of dry CH_2Cl_2 are stirred with 0.34 g (4.3 mmol) of pyridine and 0.44 g (4.3 mmol) of Ac_2O for 4 h. The mixture is diluted with 20 ml of CH_2Cl_2, cooled to 0°C, and quickly washed with ice-cold 2 *N* HCl (20 ml). The CH_2Cl_2 layer is immediately separated and instantly washed with satd. $NaHCO_3$ solution (20 ml) and brine (20 ml), dried, and evaporated. CC (Et_2O/CH_2Cl_2 7/3) affords **29** as a colourless oil.

Yield: 0.62 g (68%); IR (film): $\nu = 3292$ (NH), 1650 (C=O) cm^{-1}; ^1H NMR ($CDCl_3$): $\delta = 1.90$ (s, 3H, $COCH_3$), 2.15–2.43 (m, 2H, CH_2), 3.48–4.03 (m, 10H, OCH_2CH_2O and 2 OCH_3), 4.77–5.07 (m, 1H, CH), 6.47–7.47 (m, 8H, arom, and 1H, NH, exch.) ppm; $C_{21}H_{25}NO_5$ (371.4); calcd.: C 67.91, H 6.78, N 3.77; found: C 67.25, H 6.72, N 3.96.

N-(2-(2-(4-Methoxyphenyl)-1,3-dithiolan-2-yl)-1-(4-methoxyphenyl)ethyl)acetamide (**30**)

At room temp., 8.02 g (22.2 mmol) of **27** in 200 ml of dry CH_2Cl_2 are treated with 2.6 g (33 mmol) of pyridine and 3.37 g (33 mmol) of Ac_2O. After stirring for 4 h, the mixture is diluted with 100 ml of CH_2Cl_2, washed with 2 *N* HCl (70 ml), satd. $NaHCO_3$ solution (70 ml), and brine (70 ml), dried, and evaporated. After drying at the oil pump, for foamy residue (9.05 g) is dissolved in 20 ml of Et_2O and left first at room temp., then at 4°C, then at −18°C for crystallization to give slightly yellow crystals.

Yield: 8.17 g (91%); m.p.: 118°C; IR (KBr): $\nu = 3261$ (NH), 1644 (C=O) cm^{-1}; ^1H NMR ($CDCl_3$): $\delta = 1.77$ (s, 3H, $COCH_3$), 2.70–2.90 (m, 2H, CH_2), 3.07–3.40 (m, 4H, SCH_2CH_2S), 3.75 (s, 3H, OCH_3), 3.80 (s, 3H, OCH_3), 4.63–4.95 (m, 1H, CH), 5.87 (d, $J = 10$ Hz, 1H, NH, exch.), 6.70–7.17 (m, 6H, arom), 7.50–7.73 (m; 2H, arom) ppm; $C_{21}H_{25}NO_3S_2$ (403.6); calcd.: C 62.50, H 6.24, N 3.47; found: C 62.39, H 6.27, N 3.62.

N-(2-(2-(4-Methoxyphenyl)-1,3-dithian-2-yl)-1-(4-methoxyphenyl)acetamide (**31**)

The procedure described for **30** is used starting from 8.34 g (22.2 mmol) of **28**. CC (CH_2Cl_2/Et_2O 7/3; for application onto the silica, the residue is taken up in CH_2Cl_2) affords **31** as a colourless foam.

Yield: 8.71 g (94%); IR (film): $\nu = 3280$ (NH), 1650 (C=O) cm^{-1}; ^1H NMR ($CDCl_3$): $\delta = 1.72$ (s, 3H, $COCH_3$), 1.80–2.07 (m, 2H, $SCH_2CH_2CH_2S$), 2.37–2.83 (m, 6H, CH_2 and $SCH_2CH_2CH_2S$), 3.73 (s, 3H, OCH_3), 3.83 (s, 3H, OCH_3), 4.83–5.17 (m, 1H, CH), 5.58 (d, $J = 9$ Hz, 1H, NH, exch.), 6.67–7.15 (m, 6H, arom), 7.73–7.93 (m, 2H, arom) ppm; $C_{22}H_{27}NO_3S_2$ (417.6); calcd.: C 63.28, H 6.52, N 3.35; C 62.71, H 6.36, N 3.50.

N-(1,3-Bis(4-methoxyphenyl)-3-oxo-1-propyl)acetamide (**32**)

2.2 ml of H_2O and 40 drops of CF_3COOH are added to a solution of 0.74 g (2 mmol) of **29** in 6 ml of slightly warmed EtOH. After 4 h at room temp. and 5 h at 4°C, the crystals are sucked off, washed successively with satd. $NaHCO_3$ solution (2×5 ml) and water (2×6 ml), dried, and recrystallized from 0.6 ml of EtOH to afford **32** as colourless crystals.

Yield: 0.46 g (70%); m.p.: 128°C; IR (KBr): $\nu = 3272$ (NH), 1679 (C=O), 1636 (NC=O) cm^{-1}; ^1H NMR ($CDCl_3$): $\delta = 1.97$ (s, 3H, $COCH_3$), 3.13–3.87 (m, 2H, CH_2), 3.73 (s, 3H, OCH_3), 3.87 (s, 3H, OCH_3), 5.33–5.60 (m, 1H, CH), 6.70–7.00 (m, 4H, arom and 1H, NH, exch.), 7.13–7.33 (m, 2H, arom), 7.80–8.00 (m, 2H, arom) ppm; $C_{19}H_{21}NO_4$ (327.4); calcd.: C 69.71, H 6.47, N 4.28; found: C 69.44, H 6.54, N 4.30.

32 *from* **30** *or* **31**

A solution of 11.3 g (40 mmol) of chloramine T (N-chlorotoluenesulfonamide sodium salt) in 35 ml of MeOH and 9 ml of H_2O is added to a solution of 10 mmol of **30** or **31** in 17 ml of MeOH. After stirring at room temp. for 10 min the mixture is poured into 500 ml of H_2O, alkalized by addition of 50 ml of 3 *N* NaOH, and extracted with EtOAc (3×100 ml). The combined EtOAc phases are washed with 3 *N* NaOH (3×100 ml) and brine (2×100 ml), dried, and evaporated.

After drying at the oil pump, recrystallization from 5 ml of EtOH affords **32** as colourless crystals. Yield: 2.91 g (89%).

N-(3-Hydroxyimino-1,3-bis(4-methoxyphenyl)-1-propyl)acetamide (**33**)

3.27 g (10 mmol) of **32** and 1.74 g (25 mmol) of hydroxylammonium chloride in 8 ml of pyridine are stirred for 3 h at 70°C. Pyridine is removed *in vacuo*; the residue is thoroughly mixed with 30 ml of 2 *N* HCl and 20 ml of EtOAc and left for crystallization. The crystals formed are filtered off, washed successively with 2 *N* HCl (10 ml), satd. $NaHCO_3$ solution (2×10 ml), and H_2O (2×10 ml), and dried to give a first crop (2.49 g) of crude **33**.

After dilution of the filtrate with 20 ml of EtOAc, the org. phase is separated, washed with satd. $NaHCO_3$ solution (10 ml) and brine (2×10 ml), dried, and evaporated to give a brown oil (0.58 g) which crystallizes upon drying at the oil pump. The two crops are combined and recrystallized from 9 ml of nitromethane to afford **33** as colourless crystals.

Yield: 2.74 g (80%); m.p.: 172°C; IR (KBr): $\nu = 3311$ (br, OH and NH), 1648 (C=O) cm^{-1}; ^1H NMR (*DMSO*-d_6): $\delta = 1.73$ (s, 3H, $COCH_3$), 2.93–3.23 (m, 2H, CH_2), 3.73 (s, 3H, OCH_3), 3.78 (s, 3H, OCH_3), 4.97–5.33 (m, 1H, CH), 6.73–7.60 (m, 8H, arom), 8.26 (d, $J = 9$ Hz, 1H, NH, exch.), 11.12 (s, 1H, OH, exch.) ppm; $C_{19}H_{22}N_2O_4$ (342.4); calcd.: C 66.65, H 6.48, N 8.18; C 66.43, H 6.58, N 8.15.

N-(3-Methoxyimino-1,3-bis(4-methoxyphenyl)-1-propyl)acetamide (**34**)

2.29 g (7 mmol) of **32** and 1.17 g (14 mmol) of O-methylhydroxylammonium chloride in 5 ml of pyridine are stirred for 7 h at 70°C. Pyridine is removed *in vacuo*; the residue is mixed with 25 ml of 2 *N* HCl and extracted with EtOAc (3×40 ml). The combined org. layers are washed with satd. $NaHCO_3$ solution (30 ml) and brine (2×30 ml), dried, and evaporated. After drying at the oil pump, recrystallization from 4 ml of EtOH gives **32** as colourless crystals.

Yield: 1.54 g (69%); m.p.: 132°C; IR (KBr): $\nu = 3305$ (NH), 1652 (C=O) cm^{-1}; ^1H NMR ($CDCl_3$): $\delta = 1.87$ (s, 3H, $COCH_3$), 2.80–3.10 (m, 1H, *H*CH), 3.27–3.57 (m, 1H, HC*H*), 3.75 (s, 3H, OCH_3), 3.80 (s, 3H, OCH_3), 3.93 (s, 3H, $NOCH_3$), 4.83–5.23 (m, 1H, CH), 6.40 (d, $J = 7$ Hz, 1H, NH, exch.), 6.73–6.97 (m, 4H, arom), 7.12–7.33 (m, 2H, arom), 7.45–7.67 (m, 2H, arom) ppm; $C_{20}H_{24}N_2O_4$ (356.4); calcd.: C 67.40, H 6.79, N 7.86; found: C 67.22, H 6.95, N 7.95.

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