

## Synthesis of the Chiral Auxiliary 1,3:4,6-Di-*O*-benzylidene-2,5-dideoxy-2,5-imino-D-iditol

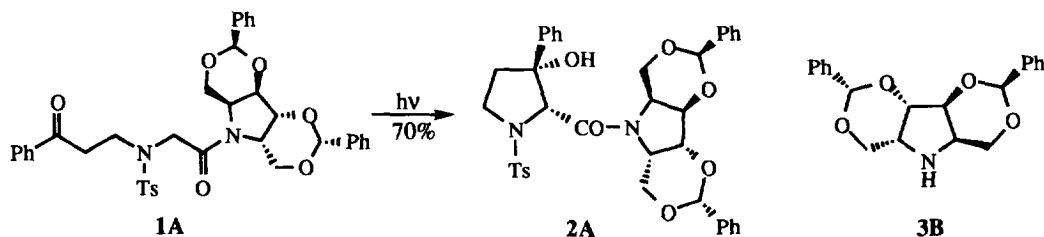
Bernd Giese<sup>a</sup>, Stephan N. Müller<sup>a</sup>, Caroline Wyss<sup>a</sup>, and Hans Steiner<sup>b</sup>

<sup>a</sup> Institute of Organic Chemistry, University of Basel, St. Johannis-Ring 19, CH-4056 Basel, Switzerland

<sup>b</sup> Ciba-Geigy AG, Katalyse & Synthesedienste FD 6, R-1055.6.66, CH-4002 Basel, Switzerland

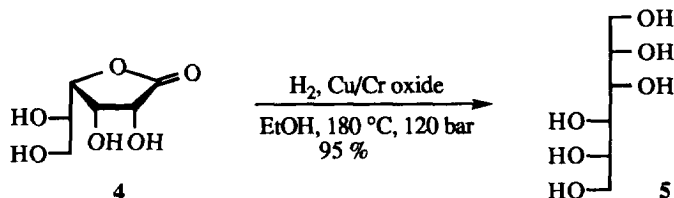
**Abstract:** *L*-Mannitol 5, the precursor of the the  $C_2$ -symmetrical auxiliary 3B, was prepared in high yield by heterogeneous reduction of *L*-mannonic- $\gamma$ -lactone 4. The auxiliary 3B could be used for stereoselective photochemical synthesis of the *L*-proline derivative 2B. Copyright © 1996 Elsevier Science Ltd

Recently, we have described a highly stereoselective photochemical synthesis of D-proline derivative 2A by photolysis of glycine derivative 1A.<sup>1</sup>

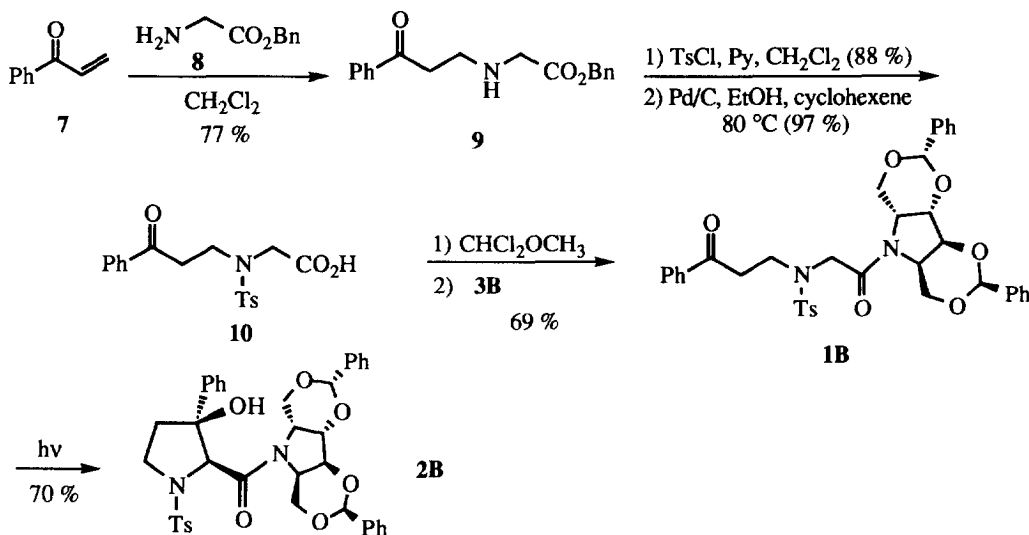


In order to synthesize the derivative of the *L*-amino acid 2B the photocyclization has to be carried out with 3B the enantiomer of auxiliary 3A. In this communication we describe the synthesis of the auxiliary 3B as well as a novel route towards the photoeducts 1A and 1B.

Starting material for auxiliary 3A is the commercially available D-mannitol.<sup>2</sup> The enantiomeric, unnatural *L*-mannitol 5, however, has to be synthesized from a suitable precursor. In 1939 Fischer described the heterogeneous reduction of *L*-mannonic- $\gamma$ -lactone 4 to *L*-mannitol 5 in 65 % yield.<sup>3</sup> For this procedure a Pt/Fe oxide catalyst was prepared according to Glattfeld and Shaver.<sup>4</sup> We now have found that a Cu/Cr oxide catalyst which had been applied previously in reductions of lactones to diols<sup>5</sup> is a much better catalyst for the reduction of mannonic- $\gamma$ -lactone 4 to *L*-mannitol 5.



Treatment of mannonic- $\gamma$ -lactone **4** with the Cu/Cr oxide catalyst<sup>6</sup> at 180°C and 120 bar hydrogen pressure in an autoclave gave L-mannitol **5** in 95 % yield.<sup>7</sup> Starting from **5** the auxiliary **3B** was prepared in analogy to the literature procedure for the synthesis of **3A**<sup>2,8</sup>, and was employed in the photochemical cyclization of **1B** to the enantiomeric L-proline derivative **2B**. In this context we have developed a much easier access to the photoeduct **1B**. The key step of the new procedure involves a Michael-addition<sup>9</sup> of the amino acid derivative **8** to the unsaturated ketone **7**. Tosylation of the secondary amine **9** and deprotection by transfer hydrogenolysis<sup>10</sup> yielded the carboxylic acid **10**. The photoeduct **1B** was obtained by first treating the acid **10** with dichloromethyl methyl ether<sup>11</sup> and then with the auxiliary **3B**. Photolysis of **1B** under conditions that we have described recently<sup>1</sup> gave the derivative of L-proline **2B**.<sup>12</sup>



**Acknowledgement:** This work was supported by the Swiss National Science Foundation.

#### References and Notes

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4. J. W. E. Glattfeld, H. Shaver, *J. Am. Chem. Soc.* **1927**, *49*, 2306.
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6. 40 % Cu, 26 % Cr; Girdler G 13P, Firma Süd-Chemie, München
7. A suspension of 25.0 g (140 mmol) L-mannonic- $\gamma$ -lactone **4** and 5.0 g Cu/Cr oxide catalyst in 500 ml ethanol was transferred to a stainless 1L steel autoclave. The mixture was hydrogenated for 10 hours (170°–180°C, 120 bar). The reaction stopped after absorption of the theoretical amount of hydrogen. Dilution of the reaction mixture, filtration and removal of the solvent under reduced pressure gave product **5** in 95 % yield. The physical data are identical with those of commercially available D-mannitol: m.p. 166–168 °C; <sup>1</sup>H-NMR (300 MHz, D<sub>2</sub>O):  $\delta$ = 3.6–3.9 (m, 14H); <sup>13</sup>C-NMR (75.5 MHz, D<sub>2</sub>O):  $\delta$ = 70.3, 76.4, 77.9.
8. The NMR data of auxiliary **3B** are identical to the literature data of the enantiomer.<sup>2</sup> Colourless crystals with m.p. 122–123 °C,  $[\alpha]_D^{26}$  = -8.0 (*c* = 1.0, CHCl<sub>3</sub>).
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12. All new compounds were characterized by <sup>1</sup>H-NMR, <sup>13</sup>C-NMR, and MS.