Supporting Information File

Selective aldehyde reduction in ketoaldehydes with NaBH₄-Na₂CO₃-H₂O at room temperatures

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Synthesis and characterization data

Instruments employed: Perkin-Elmer 410 (FTIR); Bruker AV-400 (NMR); Micromass Q-TOF AMPS MAX 10/6A (HRMS); Stuart SMP10 (melting point); Büchi Rotavapor R-200 (rotary evaporator).

IR values are for neat samples and are quoted in cm⁻¹. NMR spectra were recorded in CDCl₃ solution with tetramethylsilane as internal standard at either 400 MHz (δ_H) or 100 MHz (δ_C); the coupling constants (*J*) are in Hz. Abbreviations: Mp (melting point), s (singlet); d (doublet); t (triplet); q (quartet); br (broad); dd (doublet of doublet), etc. The nomenclatures of all the compounds were derived by ChemDraw (CambridgeSoft).

The ketoaldehydes **6a-b**,¹ **6c-f**,² **6h**,³ **6i**,⁴ and **6j**⁵ were synthesized according to literature procedures. 4-Acetylbenzaldehyde (**6g**) was purchased from Sigma-Aldrich and used without any further purification. (*cf.* Scheme 2 and Table 1 of main paper for **6a-j**.)

Representative procedure for the selective reduction of aldehydes and ketones

To a clear solution of sodium borohydride (48 mg, 1.25 mmol) and Na₂CO₃ (1.0 g, 10.5 mmol) in deionised water (2 ml) at room temperature was added a solution of mixed aldehyde (4.2 mmol) and ketone (4.2 mmol). After stirring for 2.5 h, the mixture was worked-up with saturated NH₄Cl solution, extracted with diethyl ether and the solvent was evaporated in *vacuo*. The ¹H NMR spectrum of the crude residue provided the chemoselectivity ratio. The residue was chromatographed on silica gel (100-200 mesh, eluted with ethyl acetate-hexane 5:95-10:90), to obtain pure 1° alcohol and unreacted ketone.

This procedure is followed for other aldehydes and ketones.

Determination of chemoselectivity

The chemoselectivity was determined by using the ¹H-NMR spectra of crude reaction mixture.

% Aldehyde reduction = x

% Ketone reduction = y

$$x = \frac{\int R_1-CH_2-OH}{\int R_1-CH_2-OH + (2 \times \int R_1-CHO)}$$

$$y = \frac{\int R_2-CH(OH)-CH_2R_3}{\int R_2-CH(OH)-CH_2R_3 + \int R_2-CO-CH_2R_3}$$

$$\% \text{ Chemoselectivity} = \frac{x}{x + y} \times 100$$

Representative procedure for the chemoselective reduction of ketoaldehydes

Typically, a clear solution of sodium borohydride (44.3 mg, 1.2 mmol) and Na₂CO₃ (0.8 g, 7.8 mmol) in deionised water (2 ml) at room temperature, was treated with the ketoaldehyde (3.9 mmol) in one portion. The resulting mixture was stirred for 0.5 h and worked-up with saturated NH₄Cl solution and extraction with ether. The extracts were dried (Na₂SO₄) and the solvent was evaporated in *vacuo*. The ¹H NMR spectrum of the crude residue provided the chemoselectivity ratio. The residue was chromatographed on silica gel (100-200 mesh, eluting with ethyl acetate-hexane 5:95-10:90), to obtain the pure ketoalcohol. (In the case of **1e** and **1f** the reactions were conducted at 5-10 °C.)

Table 1. Chemoselectivity between benzaldehyde and acetophenone

Entry			NaBH ₄ (mmol)	Na ₂ CO ₃ /H ₂ O (g/ml)	Time (h)			Chemoselectivity (%)
1	4.16	4.16	2.5	0.4/ 2	2	22	>99	81
2	4.16	4.16	2.5	0.2/ 2	2	76	>99	57
3	4.16	4.16	2.5	0.0/ 2	2	98	>99	1
4	4.16	4.16	5.0	1.0/ 2	2	13	>99	89
5	4.16	4.16	2.5	1.0/ 2	2	8	>99	92
6	4.16	4.16	1.5	1.0/ 2	2	6	>99	94

Aromatic aldehydes (**A1a-A1d**)

Aliphatic aldehydes (**A2a-A2b**)

Aromatic ketones (**K1a-K1d**)

Aliphatic ketones (**K2a-K2d, K3**)

Scheme 1. Aldehydes and ketones used for chemoselectivity study

Table 2. Chemoselectivity between aromatic aldehydes and ketones

Starting materials	Chemo-selectivity (%)	Yield of 1° alcohol isolated (%)	Recovery of ketone (%)	Starting materials	Chemo-selectivity (%)	Yield of 1° alcohol isolated (%)	Recovery of ketone (%)
A1a/K1a	94	> 99	94	A1c/K1a	> 99	82	> 99
A1a/K1b	93	> 99	92	A1c/K1b	> 99	85	> 99
A1a/K1c	82	40	90	A1c/K1c	94	65	> 95
A1a/K1d	95	57	92	A1c/K1d	89	54	91
A1a/K2a	89	> 90	85	A1c/K2a	98	> 99	> 95
A1a/K2b	95	87	93	A1c/K2b	95	69	92
A1a/K2c	86	> 99	82	A1c/K2c	> 99	65	> 99
A1a/K2d	> 99	37	> 99	A1c/K2d	97	79	> 95
A1a/K3	86	83	85	A1c/K3	96	63	> 95
A1b/K1a	90	97	86	A1d/K1a	95	53	> 95
A1b/K1b	90	18	> 95	A1d/K1b	98	69	> 95
A1b/K1c	61	60	58	A1d/K1c	80	44	86
A1b/K1d	94	93	92	A1d/K1d	> 99	36	> 99
A1b/K2a	68	76	62	A1d/K2a	90	35	> 95
A1b/K2b	> 99	85	> 99	A1d/K2b	> 99	89	> 99
A1b/K2c	87	> 99	85	A1d/K2c	86	49	90
A1b/K2d	> 99	95	> 99	A1d/K2d	69	52	75
A1b/K3	63	63	61	A1d/K3	60	76	48

Table 3. Chemoselectivity between aliphatic aldehydes and ketones

Starting materials	Chemo-selectivity (%)	Yield of 1° alcohol isolated (%)	Recovery of ketone (%)
A2a/K1a	92	95	91
A2a/K1b	82	> 99	85
A2a/K1c	80	83	78
A2a/K1d	> 99	> 99	> 99
A2a/K2a	91	92	90
A2a/K2b	93	98	92
A2a/K2c	75	> 99	66
A2a/K2d	75	94	69
A2a/K3	> 99	92	> 99
A2b/K1a	78	> 99	68
A2b/K1b	90	> 99	86
A2b/K1c	84	93	82
A2b/K1d	> 99	> 99	> 99
A2b/K2a	93	> 99	91
A2b/K2b	93	99	87
A2b/K2c	81	> 99	76
A2b/K2d	72	96	62
A2b/K3	76	95	68

Characterization data for ketoalcohols 7 (*cf.* Scheme 2 and Table 1 of main paper for **7a-j**)

7-Hydroxyheptan-2-one (7a). Oil; ν_{max} 3413, 2937, 2863, 1708, 1052; δ_{H} 3.63-3.59 (2H, t, *J* 6.6), 2.45-2.40 (2H, t, *J* 7.2), 2.11 (3H, s), 1.93 (1H, s), 1.63-1.50 (4H, m), 1.38-1.28 (2H, m); δ_{C} 23.3, 25.2, 29.8, 32.3, 43.5, 62.4, 209.2; HRESIMS: 153.0896 (calcd. for $\text{C}_7\text{H}_{14}\text{O}_2 + \text{Na}$ 153.0891).

5-(2-Hydroxyethyl)-6-methylhept-6-en-2-one (7b). Oil; ν_{max} 3413, 3072, 2935, 2875, 1712, 1643, 1371, 1054; δ_{H} 4.81-4.75 (2H, d, *J* 17.4), 3.66-3.58 (2H, m), 2.40-2.35 (2H, t, *J* 7.2), 2.18 (3H, s), 1.76-1.52 (8H, m); δ_{C} 209.0, 146.6, 17.5, 112.8, 61.1, 43.5, 41.3, 36.0, 30.0, 26.5; HRESIMS: 193.1207 (calcd. for $\text{C}_{10}\text{H}_{18}\text{O}_2 + \text{Na}$ 193.1204).

4-Hydroxy-3,3-dimethylbutan-2-one (7c). Oil; ν_{max} 3448, 3058, 2924, 1678, 1468, 1361, 1229, 1193, 1018, 861, 822, 747, 667; δ_{H} 3.57-3.55 (2H, d, *J* 6.4), 2.17 (3H, s), 1.17 (6H, s); δ_{C} 215.2, 69.3, 49.2, 25.5, 21.5; HRESIMS: 137.0732 (calcd. for $\text{C}_6\text{H}_{12}\text{NaO}_2 + \text{Na}$ 139.0735).

3-Hydroxy-2,2-dimethyl-1-phenylpropan-1-one (7d). Oil; ν_{max} 3346, 3032, 3003, 2923, 2869, 1682, 1607, 1430, 1357, 1268, 1182, 954, 815, 676; δ_{H} 7.76-7.74 (2H, d, *J* 8.4), 7.51-7.39 (3H, m), 3.68 (2H, s), 2.84 (1H, s), 1.38 (6H, s); δ_{C} 209.4, 137.7, 131.4, 128.1, 127.9, 70.7, 48.9, 22.8; HRESIMS: 201.0890 (calcd. for $\text{C}_{11}\text{H}_{14}\text{O}_2 + \text{Na}$ 201.0891).

3-Hydroxy-1-(4-methoxyphenyl)-2,2-dimethylpropan-1-one (7e). Oil; $\nu_{\max}$ 3335, 3027, 2998, 2945, 2842, 1683, 1604, 1445, 1357, 1272, 1167, 945, 822, 776; δ_{H} 7.76-7.74 (2H, d, *J* 8.8), 7.02-6.99 (2H, d, *J* 8.4), 3.82 (3H, s), 3.58 (3H, s), 2.69 (1H, s), 1.32 (6H, s); δ_{C} 210.9, 164.8, 130.7, 129.5, 115.2, 70.6, 57.2, 49.6, 21.3; HRESIMS: 231.0994 (calcd. for $\text{C}_{12}\text{H}_{16}\text{O}_3 + \text{Na}$ 231.0997).

3-Hydroxy-2,2-dimethyl-1-(4-nitrophenyl)propan-1-one (7f). Oil; $\nu_{\max}$ 3345, 3027, 3001, 2923, 2850, 1696, 1602, 1527, 1362, 1345, 1322, 1267, 1247, 1108, 967, 857, 745, 693; δ_{H} 8.35-8.33 (2H, d, *J* 8.8), 8.15-8.13 (2H, d, *J* 8.8), 3.37 (2H, s), 2.47 (1H, s), 1.33 (6H, s); δ_{C} 211.2, 153.9, 144.7, 129.8, 123.1, 71.5, 52.2, 20.9; HRESIMS: 246.0743 (calcd. for $\text{C}_{11}\text{H}_{13}\text{NO}_4 + \text{Na}$ 246.0742).

1-(4-(Hydroxymethyl)phenyl)ethan-1-one (7g). Mp 52 °C (lit.⁹ 51-54 °C); $\nu_{\max}$ 3339, 3030, 2924, 1678, 1599, 1583, 1449, 1430, 1360, 1265, 1180, 1024, 955, 927, 760, 690; δ_{H} 7.39-7.36 (2H d, *J* 8.8), 6.87-6.85 (2H, d, *J* 7.6), 4.625 (2H, s), 2.92 (1H, s), 2.51 (6H, s); δ_{C} 197.5, 148.5, 143.5, 129.2, 128.8, 66.5, 27.1; HRESIMS: 173.0578 (calcd. for $\text{C}_9\text{H}_{10}\text{O}_2 + \text{Na}$ 173.0578).

(4-(Hydroxymethyl)phenyl)(phenyl)methanone (7h). Mp 61-62 °C (lit.⁹ 61-64 °C); $\nu_{\max}$ 3340, 3023, 2998, 2923, 2854, 1695, 1608, 1425, 1356, 1269, 1185, 954, 815, 673; δ_{H} 7.76-7.73 (3H, m), 7.59-7.40 (4H, m), 7.34-7.22 (2H, m), 4.72 (2H, s), 2.97 (1H, s); δ_{C} 196.7, 145.7, 137.4, 136.4, 132.4, 130.3, 129.9, 128.2, 126.3, 64.4; HRESIMS: 235.0735 (calcd. for $\text{C}_{14}\text{H}_{12}\text{O}_2 + \text{Na}$ 235.0735).

1-(4-(Hydroxymethyl)phenoxy)propan-2-one (7i). Oil; $\nu_{\max}$ 3342, 3045, 2997, 2923, 2869, 1703, 1600, 1359, 1219, 1170, 951, 771; δ_{H} 7.01-6.98 (2H, d, *J* 8.8), 6.89-6.87 (2H, d, *J* 8.8), 5.07 (2H, s), 4.56 (2H, s), 2.81 (1H, br s), 2.22 (6H, s); δ_{C} 203.3, 156.1, 133.1, 128.6, 117.6, 82.8, 64.5, 24.8; HRESIMS: 203.0685 (calcd. for $\text{C}_{10}\text{H}_{12}\text{O}_3 + \text{Na}$ 203.0684).

2-(4-(Hydroxymethyl)phenoxy)-1-phenylethan-1-one (7j). Oil; $\nu_{\max}$ 3334, 3049, 2991, 2917, 2878, 1676, 1602, 1438, 1365, 1276, 1178, 965, 823, 776; δ_{H} 8.10-8.08 (2H, d, *J* 8.8), 7.70-7.52 (3H, m), 6.98-6.96 (2H, d, *J* 8.8), 6.87-6.85 (2H, d, *J* 9.2), 5.59 (2H, s), 4.65 (2H, s), 2.20 (1H, s); δ_{C} 193.9, 157.6, 134.6, 133.6, 133.1, 129.4, 128.9, 128.6, 116.4, 75.3, 65.6; HRESIMS: 265.0840 (calcd. for $\text{C}_{15}\text{H}_{14}\text{O}_3 + \text{Na}$ 265.0841).

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