## Hydriodic Acid-Mediated Cyclization of α-Substituted Secondary 2-Ethenylbenzamides: Synthesis of 2-Substituted 2,3-Dihydro-3,3dimethyl-1*H*-isoindol-1-ones and 3,3-Disubstituted (*E*)-1-(Arylimino)-1,3-dihydroisobenzofurans

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A new and facile method for the preparation of 2-substituted 2,3-dihydro-3,3-dimethyl-1*H*-isoindol-1-ones **3** and 3,3-disubstituted (*E*)-1-(arylimino)-1,3-dihydroisobenzofurans **6** has been developed. Thus, treatment of *N*-alkyl(or aryl)-2-(1-methylethen-1-yl)benzamides **2** with concentrated hydriodic acid (HI) in MeCN at room temperature afforded **3**. Similar treatment of *N*-aryl-2-(1-phenylethen-1yl)benzamide **5** with concentrated HI at  $0^{\circ}$  afforded **6**.

Introduction. - We previously reported a synthesis of 3,3-disubstituted-2,3-dihydro-1*H*-isoindol-1-ones based on iodoamination of  $\alpha$ -substituted secondary 2-ethenylbenzamides, which could be prepared by the reaction of  $\alpha$ -substituted 2-lithiostyrenes with isocyanates [1]. As an extension of this work, we herein describe the results of our study on HI-mediated cyclization of  $\alpha$ -substituted secondary 2-ethenylbenzamides, which provide concise and efficient synthetic routes to 2-substituted 2,3-dihydro-3,3dimethyl-1*H*-isoindol-1-ones and 3,3-disubstituted (*E*)-1-(arylimino)-1,3-dihydroisobenzofurans depending on the  $\alpha$ -substituents of  $\alpha$ -substituted secondary 2-ethenylbenzamides. The synthesis of 2,3-dihydro-1H-isoindol-1-ones has recently attracted considerable attention owing to the occurrence of biological active compounds containing this heterocyclic system [2]. A number of methods for the synthesis of this system have been developed [3]. However, most of these methods require several steps and/or involve tedious reaction conditions. On the other hand, a few general methods have been reported for the preparation of 1-(alkyl(or aryl)imino)-1,3-dihydroisobenzofuran derivatives [4]. For example, *Kunai* and co-workers have reported a synthesis of 3,3-disubstituted 1-(tert-octylimino)-1,3-dihydroisobenzofurans by three-component coupling using arynes and *tert*-octyl isocyanide [4a][4c]. This class of molecules may be of biological interest, because a number of molecules, which have a related isobenzofuran-1(3H)-one (phthalide) structure, have exhibited a variety of biological activities [5].

**Results and Discussion.** – 2,3-Dihydro-3,3-dimethyl-1*H*-isoindol-1-ones **3** were synthesized from 2-bromo- $\alpha$ -methylstyrenes **1** via N-alkyl(or aryl)-2-(1-methylethen-1-yl)benzamides **2** as outlined in *Scheme 1*. The 2-ethenylbenzamides **2** were prepared

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from the 2-bromostyrenes **1** as described in [1]. Thus, Li/Br exchange between **1** and BuLi in Et<sub>2</sub>O at 0° generated the corresponding 2-lithiostyrene derivatives. These were then allowed to react with isocyanates to afford 2-ethenylbenzamides **2** in moderate-to-fair yields. First, 2-(1-methylethen-1-yl)-*N*-phenylbenzamide (**2a**) was treated with 2 mol-equiv. of HI in MeCN at room temperature to yield the desired 2,3-dihydro-3,3-dimethyl-2-phenyl-1*H*-isoindol-1-one (**3a**) in fair yield. The IR and <sup>1</sup>H-NMR spectra were identical to those reported in [1]. The use of less than 2 mol-equiv. of HI gave decreased yields of the desired product. Conversion of the other 2-(1-methylethen-1-yl)benzamides **2b** – **2e** to the 2,3-dihydro-1*H*-isoindol-1-ones **3b** – **3e**, respectively, was performed under the same conditions in comparable yields. These results are summarized in *Table 1*.



Table 1. Preparation of 2,3-Dihydro-1H-isoindol-1-ones 3 from 1 via 2

Entry	Starting material	<b>R</b> <sup>3</sup>	Intermediate	Yield <sup>a</sup> ) [%]	Product	Yield <sup>a</sup> ) [%]
1	1a	Ph	2a	65	3a	72
2	1a	$4-Cl-C_6H_4$	2b	58	3b	69
3	1b	Ph	2c	59	3c	62
4	1b	t-Bu	2d	64	3d	69
5	1c	Ph	2e	60	3e	70
a) Yield	s of isolated product	S.				

Subsequently, we investigated the cyclization of *N*-aryl-2-(1-arylethen-1-yl)benzamides **5**, which can also be prepared by reacting 2-lithio- $\alpha$ -arylstyrenes, generated from 2-bromo- $\alpha$ -arylstyrenes **4** and BuLi, with aryl isocyanates, as illustrated in *Scheme 2*. The yields of **4** are summarized in *Table 2*, which indicates that they are moderate-to-fair. First, we examined the reaction of *N*-phenyl-2-(1-phenylethen-1yl)benzamide (**5a**) with concentrated HI under similar conditions as described for the preparation of 2,3-dihydro-1*H*-isoindol-1-ones **3** (*Scheme 2*). The reaction was complete at 0° in 1 h, and the precipitated product was collected. However, we found that the spectroscopic data (IR and <sup>1</sup>H-NMR) of this product were not identical to those of previously prepared 2,3-dihydro-3-methyl-2,3-diphenyl-1*H*-isoindol-1-one [1]. We determined the structure of this product to be (*E*)-1,3-dihydro-3-methyl-3-phenyl-1-(phenylimino)isobenzofuran (**6a**) on the basis of its spectroscopic data and elemental analysis (see *Exper. Part*). The signal assignable to H–C(7) appears at considerable lowfield ( $\delta$ (H) 9.98), probably due to the deshielding effect of the benzene ring of the 1-phenylimino group. The (*E*)-configuration was unambiguously determined by NOE experiments. Thus, irradiation of the signal at  $\delta(H)$  9.98 assignable to H-C(7) resulted in an enhancement (15%) of the signal at  $\delta(H)$  8.08 assignable to *ortho*-H-atoms of the benzene ring of the 1-phenylimino group. Similar treatment of the other *N*-aryl-2-(1arylethen-1-yl)benzamides **5b** – **5f** led to the formation of the 3,3-disubstituted (*E*)-2-(arylimino)-1,3-isobenzofurans **6b** – **6f**, respectively. The yields of the products are also listed in *Table 2* which indicates that good yields are generally realized, while *N*-phenyl-2-(2-phenyl-3-methylethen-1-yl)benzamide (**5f**) gave the corresponding desired product **6f** in somewhat lower yield (*Entry 6*). The  $\beta$ -Me group of the vinyl moiety may render this cyclization difficult. The formation of the dihydro-imino-isobenzofuran structure is ascribed to the steric hindrance due to two aryl groups of the 2,3-diaryl-2,3dihydro-1*H*-isoindol-1-one structure.



Table 2. Preparation of (E)-1-(Arylimino)-2,3-dihydroisobenzofurans 6 from 4 via 5

Entry	Starting material	Ar <sup>2</sup>	Intermediate	Yield <sup>a</sup> ) [%]	6	Yield <sup>a</sup> ) [%]
1	4a	Ph	5a	53	6a	86
2	<b>4</b> a	$4-Cl-C_6H_4$	5b	63	6b	93
3	4a	$4-Br-C_6H_4$	5c	62	6c	89
4	4b	$4-Cl-C_6H_4$	5d	55	6d	88
5	4c	Ph	5e	59	6e	80
6	4d	Ph	5f	51	6f	66

The 1,3-dihydro-1-iminoisobenzofuran structure was further confirmed by converting **6a** to 3-methyl-3-phenylisobenzofuran-1(3H)-one (**7**) by acid hydrolysis, as shown in *Scheme 3*.



**4d**  $R^1$  = H,  $R^2$  = Me,  $Ar^1$  = Ph

In conclusion, the results mentioned above demonstrate that 2-substituted 2,3dihydro-3,3-dimethyl-1*H*-isoindol-1-one and 3,3-disubstituted (*E*)-1-(arylimino)-1,3dihydroisobenzofurans can be prepared from  $\alpha$ -substituted 2-bromostyrenes and isocyanates. The method should be useful in the synthesis of these classes of heterocyclic compounds, because the starting materials are readily available, and the operations are very simple.

## **Experimental Part**

General. All of the org. solvents used in this study were dried over appropriate drying agents and distilled prior to use. TLC: *Kieselgel 60 PF*<sub>254</sub> (*Merck*). Column chromatography (CC): *Kieselgel 60* (0.063–0.200 mm; *Merck*). M.p.: *Laboratory Devices MEL-TEMP II*; uncorrected. IR Spectra: *Shimadzu FTIR-8300* spectrophotometer;  $\tilde{\nu}$  in cm<sup>-1</sup>. <sup>1</sup>H-NMR Spectra: *JEOL ECP500* FT NMR spectrometer at 500 MHz or *JEOL LA400* FT NMR spectrometer at 400 MHz in CDCl<sub>3</sub>;  $\delta$  in ppm rel. to Me<sub>4</sub>Si as internal standard, *J* in Hz. <sup>13</sup>C-NMR Spectra: *JEOL ECP500* FT NMR spectrometer at 125 MHz;  $\delta$  in ppm rel. to Me<sub>4</sub>Si as internal standard. LR-EI-MS: *JEOL JMS AX505 HA* spectrometer at 70 eV; in *m/z* (rel. %).

 $\alpha$ -Substituted 2-Bromostyrenes **1a** [6], **1b** [7], **1c** [7], **4a** [8], **4b** [9], **4c** [10], and **4d** [11] were prepared by the appropriate reported methods. All other chemicals used in this study were commercially available.

*a-Substituted 2-Ethenylbenzamides* **2** and **5**. These compounds were prepared by reacting *a*-substituted 2-lithiostyrenes, generated by the Br/Li exchange between **1** and BuLi, with isocyanates under the conditions previously reported by us [1].

N-(4-Chlorophenyl)-2-(1-methylethen-1-yl)benzamide (**2b**). White solid. M.p. 138–140° (hexane/THF). IR (KBr): 3279, 3244, 1655, 1603. <sup>1</sup>H-NMR (500 MHz): 2.09 (*s*, 3 H); 5.21 (*s*, 1 H); 5.34 (*s*, 1 H); 7.28 (*dd*, J = 7.8, 0.9, 1 H); 7.32 (*d*, J = 8.7, 2 H); 7.40 (*ddd*, J = 7.8, 7.3, 0.9, 1 H); 7.46 (*ddd*, J = 7.8, 7.3, 1.4, 1 H); 7.54 (*d*, J = 8.7, 2 H); 7.79 (*dd*, J = 7.8, 1.4, 1 H); 7.99 (br. *s*, 1 H). Anal. calc. for C<sub>16</sub>H<sub>14</sub>CINO (271.74): C 70.72, H 5.19, N 5.15; found: C 70.65, H 5.24, N 5.19.

4-Methoxy-2-(1-methylethen-1-yl)-N-phenylbenzamide (**2c**). White solid. M.p.  $80-83^{\circ}$  (hexane/THF). IR (KBr): 3266, 3231, 1655, 1599. <sup>1</sup>H-NMR (500 MHz): 2.09 (*s*, 3 H); 3.87 (*s*, 3 H); 5.24 (*s*, 1 H); 5.35 (*s*, 1 H); 6.76 (*d*, J = 2.3, 1 H); 6.91 (*dd*, J = 8.2, 2.3, 1 H); 7.29–7.40 (*m*, 3 H); 7.57 (*d*, J = 7.8, 2 H); 7.83 (*d*, J = 8.2, 1 H); 8.07 (br. *s*, 1 H). Anal. calc. for C<sub>17</sub>H<sub>17</sub>NO<sub>2</sub> (267.32): C 76.38, H 6.41, N 5.24; found: C 76.26, H 6.40, N 5.17.

N-(1,1-Dimethylethyl)-4-methoxy-2-(1-methylethen-1-yl)benzamide (**2d**). A pale-yellow solid. M.p. 70–73° (hexane/CH<sub>2</sub>Cl<sub>2</sub>). IR (KBr): 3291, 1632, 1605. <sup>1</sup>H-NMR (500 MHz): 1.41 (*s*, 9 H); 2.08 (*d*, J = 0.9, 3 H); 3.83 (*s*, 3 H); 5.09 (*d*, J = 0.9, 1 H); 5.22 (*quint*, J = 0.9, 1 H); 6.15 (br. *s*, 1 H); 6.68 (*d*, J = 2.7, 1 H); 6.84 (*dd*, J = 8.7, 2.7, 1 H); 7.67 (*d*, J = 8.7, 1 H). Anal. calc. for C<sub>15</sub>H<sub>21</sub>NO<sub>2</sub> (247.33): C 72.84, H 8.56, N 5.66; found: C 72.59, H 8.60, N 5.42.

*4,5-Dimethoxy-2-(1-methylethen-1-yl)-N-phenylbenzamide* (**2e**). A pale-yellow solid. M.p.  $125-128^{\circ}$  (hexane/CH<sub>2</sub>Cl<sub>2</sub>). IR (KBr): 3271, 3242, 1645, 1599. <sup>1</sup>H-NMR (500 MHz): 2.09 (*s*, 3 H); 3.94 (*s*, 6 H); 5.25 (*s*, 1 H); 5.38 (*s*, 1 H); 6.72 (*s*, 1 H); 7.32-7.38 (*m*, 3 H); 7.43 (*s*, 1 H); 7.58 (*d*, *J* = 7.8, 2 H); 8.19 (br. *s*, 1 H). Anal. calc. for C<sub>18</sub>H<sub>19</sub>NO<sub>3</sub> (297.35): C 72.71, H 6.44, N 4.71; found: C 72.92, H 6.53, N 4.51.

N-(4-Chlorophenyl)-2-(1-phenylethen-1-yl)benzamide (**5b**). White solid. M.p. 140–143° (hexane/THF). IR (KBr): 3266, 3239, 1651. <sup>1</sup>H-NMR (500 MHz): 5.45 (*s*, 1 H); 5.85 (*s*, 1 H); 7.10 (*d*, J = 8.7, 2 H); 7.17–7.28 (*m*, 5 H); 7.42 (*d*, J = 7.3, 1 H); 7.48 (*m*, 5 H); 7.80 (*d*, J = 7.3, 1 H). Anal. calc. for C<sub>21</sub>H<sub>16</sub>ClNO (333.81): C 75.56, H 4.83, N 4.20; found: C 75.56, H 4.73, N 4.12.

N-(4-Bromophenyl)-2-(1-phenylethen-1-yl)benzamide (**5c**). White solid. M.p.  $150-152^{\circ}$  (hexane/THF). IR (KBr): 3235, 3173, 1651. <sup>1</sup>H-NMR (500 MHz): 5.44 (*s*, 1 H); 5.79 (*s*, 1 H); 7.13 (*d*, J = 8.7, 2 H); 7.23 (*s*, 5 H); 7.32 (*d*, J = 8.7, 2 H); 7.41 (*d*, J = 7.8, 1 H); 7.47 (*ddd*, J = 7.8, 7.3, 1.4, 1 H); 7.53 (*ddd*, J = 7.8, 7.3, 1.4, 1 H); 7.66 (*dd*, J = 7.8, 1.4, 1 H); 8.13 (br. *s*, 1 H). Anal. calc. for C<sub>21</sub>H<sub>16</sub>BrNO (378.26): C 66.68, H 4.26, N 3.70; found: C 66.50, H 4.32, N 3.82.

N-(4-Chlorophenyl)-2-[1-(4-methylphenyl)ethen-1-yl]benzamide (**5d**). White solid. M.p.  $115-118^{\circ}$  (hexane/CH<sub>2</sub>Cl<sub>2</sub>). IR (KBr): 3256, 3235, 1651. <sup>1</sup>H-NMR (500 MHz): 2.29 (*s*, 3 H); 5.39 (*s*, 1 H); 5.82 (*s*, 1 H); 7.04 (*d*, J = 8.2, 2 H); 7.12 (*d*, J = 8.2, 2 H); 7.13 (*d*, J = 8.7, 2 H); 7.19 (*d*, J = 8.7, 2 H); 7.40 (*dd*, J = 7.3, 1.4, 1 H); 7.48 (*td*, J = 7.3, 1.4, 1 H); 7.54 (*td*, J = 7.3, 1.4, 1 H); 7.61 (br. *s*, 1 H); 7.82 (*dd*, J = 7.3, 1.4, 1 H). Anal. calc. for C<sub>22</sub>H<sub>18</sub>CINO (347.84): C 75.97, H 5.22, N 4.03; found: C 75.76, H 5.33, N 3.76.

4-Methoxy-N-phenyl-2-(1-phenylethen-1-yl)benzamide (**5e**). White solid. M.p. 117–120° (hexane/THF). IR (KBr): 3296, 1654. <sup>1</sup>H-NMR (500 MHz): 3.89 (*s*, 3 H); 5.47 (*s*, 1 H); 5.89 (*s*, 1 H); 6.90 (*d*, J = 2.7, 1 H); 7.00 (*dd*, J = 8.7, 2.7, 1 H); 7.04 (*t*, J = 7.3, 1 H); 7.16–7.27 (*m*, 9 H); 7.65 (br. *s*, 1 H); 7.85 (*d*, J = 8.7, 1 H). Anal. calc. for C<sub>22</sub>H<sub>19</sub>NO<sub>2</sub> (329.39): C 80.22, H 5.81, N 4.25; found: C 80.06, H 5.94, N 4.05.

N-*Phenyl-2-(1-phenylpropen-1-yl)benzamide* (**5f**). A mixture of stereoisomers ((*E*)/(*Z*) *ca.* 6:4). A pale-yellow oil.  $R_{\rm f}$  (THF/hexane 1:8) 0.40. IR (neat): 3306, 1661. <sup>1</sup>H-NMR (500 MHz): 1.71 (*d*, *J* = 7.3, 1.8 H); 1.91 (*d*, *J* = 7.3, 1.2 H); 6.07 (*q*, *J* = 7.3, 0.8 H); 6.49 (*q*, *J* = 7.3, 1.2 H); 7.03 – 7.57 (*m*, 12.4 H); 7.65 (*d*, *J* = 7.3, 0.4 H); 7.78 (br. *s*, 0.6 H); 8.00 (*dd*, *J* = 7.8, 1.4, 0.6 H). Anal. calc. for C<sub>22</sub>H<sub>19</sub>NO (313.39): C 84.31, H 6.11, N 4.47; found: C 84.15, H 6.39, N 4.46.

2,3-Dihydro-3,3-dimethyl-2-phenyl-IH-isoindol-1-one (**3a**). Typical Procedure. To a stirred soln. of **2a** (0.15 g, 0.65 mmol) in MeCN (5 ml) at 0° was added dropwise conc. HI (0.31 g, 1.3 mmol). The mixture was stirred at r.t. overnight. The resulting mixture was diluted by adding Et<sub>2</sub>O (15 ml), and sat. aq. NaHCO<sub>3</sub> (10 ml) was added. The layers were separated, and the aq. layer was extracted with Et<sub>2</sub>O ( $2 \times 5$  ml). The combined extracts were washed with brine, dried (Na<sub>2</sub>SO<sub>4</sub>), and concentrated by evaporation. The residual solid was recrystallized from hexane/Et<sub>2</sub>O to give pure **3a** (96 mg, 62%). White solid. M.p. 188–190° ([12]: 191–192.5°). The spectroscopic data (IR and <sup>1</sup>H-NMR) were identical to those reported in [1][12].

2-(4-Chlorophenyl)-2,3-dihydro-3,3-dimethyl-1H-isoindol-1-one (**3b**). White solid. M.p.  $115-118^{\circ}$  (hexane/Et<sub>2</sub>O). IR (KBr): 1680. <sup>1</sup>H-NMR (400 MHz): 1.64 (*s*, 6 H); 7.26 – 7.32 (*m*, 5 H); 7.47 (*dd*, J = 8.1, 7.0, 1 H); 7.55 (*dd*, J = 7.7, 7.0, 1 H); 7.90 (*d*, J = 8.1, 1 H). <sup>13</sup>C-NMR: 27.79; 88.57; 120.68; 124.02; 125.10; 128.60; 128.71; 128.94; 129.98; 132.09; 145.35; 151.53; 158.23. MS: 271 (58,  $M^+$ ), 256 (100). Anal. calc. for C<sub>16</sub>H<sub>14</sub>CINO (271.74): C 70.72, H 5.19, N 5.15; found: C 70.57, H 5.25, N 4.98.

2,3-Dihydro-5-methoxy-3,3-dimethyl-2-phenyl-1H-isoindol-1-one (**3c**). A pale-yellow solid. M.p. 91–94° (hexane/CH<sub>2</sub>Cl<sub>2</sub>). IR (KBr): 1674. <sup>1</sup>H-NMR (400 MHz): 1.62 (*s*, 6 H); 3.90 (*s*, 3 H); 6.75 (*d*, J = 2.3, 1 H); 7.00 (*dd*, J = 8.7, 2.3, 1 H); 7.08 (*tt*, J = 7.3, 1.4, 1 H); 7.30–7.35 (*m*, 4 H); 7.85 (*d*, J = 8.7, 1 H). <sup>13</sup>C-NMR: 27.74; 55.72; 87.57; 104.89; 115.42; 122.51; 123.56; 123.64; 125.49; 128.52; 146.96; 153.86; 157.76; 163.18. MS: 267 (62,  $M^+$ ), 252 (100). Anal. calc. for C<sub>17</sub>H<sub>17</sub>NO<sub>2</sub> (267.32): C 76.38, H 6.41, N 5.24; found: C 76.09, H 6.48, N 5.18.

2-(1,1-Dimethylethyl)-2,3-dihydro-5-methoxy-3,3-dimethyl-1H-isoindol-1-one (**3d**). A pale-yellow oil.  $R_{\rm f}$  (Et<sub>2</sub>O/hexane 1:1) 0.25. IR (neat): 1690, 1613. <sup>1</sup>H-NMR (400 MHz): 1.38 (*s*, 9 H); 1.57 (*s*, 6 H); 3.86 (*s*, 3 H); 6.68 (*d*, J = 2.2, 1 H); 6.89 (*dd*, J = 8.4, 2.2, 1 H); 7.68 (*d*, J = 8.4, 1 H). <sup>13</sup>C-NMR: 27.86; 30.02; 53.25; 55.59; 85.89; 104.82; 114.70; 123.81; 124.98; 152.76; 155.85; 162.36. MS: 247 (69,  $M^+$ ), 191 (100). Anal. calc. for C<sub>15</sub>H<sub>21</sub>NO<sub>2</sub> (247.33): C 72.84, H 8.56, N 5.66; found: C 72.64, H 8.54, N 5.61.

2,3-Dihydro-5,6-dimethoxy-3,3-dimethyl-2-phenyl-1H-isoindol-1-one (**3e**). A pale-yellow oil.  $R_{\rm f}$  (THF/hexane 1:2) 0.45. IR (neat): 1674. <sup>1</sup>H-NMR (500 MHz): 1.62 (*s*, 6 H); 3.96 (*s*, 3 H); 3.98 (*s*, 3 H); 6.72 (*s*, 1 H); 7.09 (*t*, J = 7.3, 1 H); 7.29 – 7.37 (*m*, 5 H). <sup>13</sup>C-NMR: 27.76; 56.22; 56.28; 87.78; 102.07; 105.06; 119.56; 121.90; 123.58; 128.52; 145.30; 146.88; 150.10; 153.11; 158.31. MS: 297 (29,  $M^+$ ), 282 (100). Anal. calc. for  $C_{18}H_{19}NO_3$  (297.35): C 72.71, H 6.44, N 4.71; found: C 72.52, H 6.31, N 5.00.

(E)-2,3-Dihydro-3-methyl-3-phenyl-1-(phenylimino)isobenzofuran (**6a**). Typical Procedure. To a stirred soln. of **5a** (0.21 g, 0.71 mmol) in MeCN at 0° was added conc. HI (0.32 g, 1.4 mmol). The mixture was stirred for 1 h at the same temp. The precipitate was collected by filtration and recrystallized from hexane/Et<sub>2</sub>O to give **6a** (0.18 g, 86%). White solid. M.p. 173–175°. IR (KBr): 1659. <sup>1</sup>H-NMR (500 MHz): 2.26 (*s*, 3 H); 7.34–7.36 (*m*, 2 H); 7.40–7.51 (*m*, 7 H); 7.81 (*dd*, J = 7.8, 7.3, 1 H); 7.92 (*dd*, J = 7.8, 7.3, 1 H); 8.08 (*d*, J = 7.8, 2 H); 9.98 (*d*, J = 7.8, 1 H). <sup>13</sup>C-NMR (125 MHz): 26.30; 102.41; 122.19; 123.21; 123.93; 125.49; 129.09; 129.40; 129.47; 130.22; 130.43; 130.97; 133.35; 136.12; 137.46; 152.12; 169.64. MS: 299 (100,  $M^+$ ). Anal. calc. for C<sub>21</sub>H<sub>17</sub>NO (299.37): C 84.25, H 5.72, N 4.68; found: C 84.11, H 5.79, N 4.69.

(E)-1-[(4-Chlorophenyl)imino]-1,3-dihydro-3-methyl-3-phenylisobenzofuran (**6b**). A pale-yellow solid. M.p.  $125-128^{\circ}$  (hexane/CH<sub>2</sub>Cl<sub>2</sub>). IR (KBr): 1663. <sup>1</sup>H-NMR (500 MHz): 2.24 (*s*, 3 H); 7.33-7.35

(*m*, 2 H); 7.43 – 7.47 (*m*, 5 H); 7.49 (*d*, J = 7.8, 1 H); 7.80 (*dd*, J = 7.8, 7.3, 1 H); 7.90 (*dd*, J = 7.8, 7.3, 1 H); 7.92 (*d*, J = 8.7, 2 H); 9.76 (distorted *d*, J = 7.8, 1 H). <sup>13</sup>C-NMR: 26.33; 102.37; 122.24; 125.33 (two overlapped C-atoms); 125.58; 127.60; 129.48; 129.71; 130.27; 130.35; 131.08; 134.83; 136.19; 137.46; 152.16; 170.89. MS: 333 (100,  $M^+$ ). Anal. calc. for C<sub>21</sub>H<sub>16</sub>ClNO (333.81): C 75.56, H 4.83, N 4.20; found: C 75.41, H 4.91, N 4.11.

(E)-1-[(4-Bromophenyl)imino]-1,3-dihydro-3-methyl-3-phenylisobenzofuran (6c). A pale-yellow solid. M.p. 180–183° (hexane/THF). IR (KBr): 1663. <sup>1</sup>H-NMR (500 MHz): 2.24 (s, 3 H); 7.33–7.35 (m, 2 H); 7.43–7.45 (m, 3 H); 7.49 (d, J = 7.3, 1 H); 7.59 (d, J = 8.7, 2 H); 7.79 (dd, J = 7.8, 7.3, 1 H); 7.84 (d, J = 8.7, 2 H); 7.90 (t, J = 7.3, 1 H); 9.70 (distorted d, J = 7.8, 1 H). <sup>13</sup>C-NMR: 26.55; 106.35; 122.66; 124.80; 124.84; 125.22; 125.44; 128.20; 128.75; 129.32; 129.50; 131.71; 132.50; 134.92; 140.98; 154.03; 169.14. MS: 377 (100,  $M^+$ ). Anal. calc. for C<sub>21</sub>H<sub>16</sub>BrNO (378.26): C 66.68, H 4.26, N 3.70; found: C 55.39, H 4.00, N 3.79.

(E)-1-[(4-Chlorophenyl)imino]-1,3-dihydro-3-methyl-3-(4-methylphenyl)isobenzofuran (**6d**). White solid. M.p. 121–124° (hexane/THF). IR (KBr): 1663. <sup>1</sup>H-NMR (500 MHz): 2.23 (*s*, 3 H); 2.37 (*s*, 3 H); 7.20 (*d*, J = 8.7, 2 H); 7.23 (*d*, J = 8.7, 2 H); 7.43 (*d*, J = 8.7, 2 H); 7.46 (*d*, J = 7.8, 1 H); 7.79 (*dd*, J = 7.8, 7.3, 1 H); 7.90 (*dd*, J = 7.8, 7.3, 1 H); 7.92 (*d*, J = 8.7, 2 H); 9.78 (distorted *d*, J = 7.8, 1 H). <sup>13</sup>C-NMR: 21.12; 26.08; 103.10; 122.25; 123.30; 125.28; 125.65; 129.63; 130.05; 130.27; 130.97; 131.99; 132.85; 134.84; 137.55; 140.77; 152.37; 169.63. MS: 347 (100,  $M^+$ ). Anal. calc. for C<sub>22</sub>H<sub>18</sub>CINO (347.84): C 75.97, H 5.22, N 4.03; found: C 75.97, H 5.21, N 4.03.

(E)-1,3-Dihydro-5-methoxy-3-methyl-3-phenyl-1-(phenylimino)isobenzofuran (**6e**). A pale-yellow solid. M.p. 146–149° (hexane/THF). IR (KBr): 1668, 1603. <sup>1</sup>H-NMR (500 MHz): 2.22 (*s*, 3 H); 3.96 (*s*, 3 H); 6.84 (*d*, J = 2.3, 1 H); 7.26 (*dd*, J = 8.7, 2.3, 1 H); 7.33–7.38 (*m*, 3 H); 7.42–7.47 (*m*, 5 H); 7.96 (*d*, J = 7.8, 2 H); 9.85 (*d*, J = 8.7, 1 H). <sup>13</sup>C-NMR: 26.13; 56.53; 100.13; 107.18; 115.31; 117.34; 117.40; 123.65; 125.43; 128.24; 129.32; 129.96; 131.72; 134.62; 136.68; 153.23; 155.53; 167.14. MS: 329 (100,  $M^+$ ). Anal. calc. for C<sub>22</sub>H<sub>19</sub>NO<sub>2</sub> (329.39): C 80.22, H 5.81, N 4.25; found: C 80.03, H 5.85, N 4.17.

(E)-3-Ethyl-1,3-dihydro-3-phenyl-1-(phenylimino)isobenzofuran (**6f**). A pale-yellow solid. M.p. 186–189° (hexane/THF). IR (KBr): 1665. <sup>1</sup>H-NMR (500 MHz): 0.85 (t, J = 7.3, 3 H); 2.48–2.56 (m, 1 H); 2.71–2.78 (m, 1 H); 7.37–7.46 (m, 6 H); 7.51 (t, J = 7.8, 2 H); 7.59 (d, J = 7.8, 1 H); 7.78 (dd, J = 7.8, 7.3, 1 H); 7.93 (dd, J = 7.8, 7.3, 1 H); 8.02 (dd, J = 7.8, 0.9, 2 H); 9.86 (d, J = 7.8, 1 H). <sup>13</sup>C-NMR: 8.11; 32.53; 105.12; 122.38; 123.87; 124.04; 125.23; 129.01; 129.38; 129.54; 129.85; 130.19; 130.90; 133.49; 136.12; 137.24; 150.47; 169.53. MS: 313 (100,  $M^+$ ). Anal. calc. for C<sub>22</sub>H<sub>19</sub>NO (313.39): C 84.31, H 6.11, N 4.47; found: C 84.07, H 6.30, N 4.47.

3-Methyl-3-phenylisobenzofuran-1(3H)-one (7) [13]. To a stirred soln. of **6a** (0.71 g, 0.24 mmol) in 1,2-dimethoxyethane (DME; 3 ml) at 0° was added 10% aq. HCl (0.71 ml). The mixture was then heated at reflux for 30 min. The cooled mixture was diluted with H<sub>2</sub>O (10 ml) and extracted with Et<sub>2</sub>O (2 × 7 ml). The combined extracts were washed with sat. aq. NH<sub>4</sub>Cl and brine, and dried (Na<sub>2</sub>SO<sub>4</sub>). After evaporation of the solvent, the residual solid was purified by recrystallization from hexane/Et<sub>2</sub>O to give 7 (42 mg, 79%). White solid. M.p. 76–77° ([13a]: 77–78°). The spectroscopic data (IR and <sup>1</sup>H-NMR) were identical to those reported in [13c].

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