Reactions of salicylaldehyde with tris(pentafluorophenyl)silanes and secondary amines

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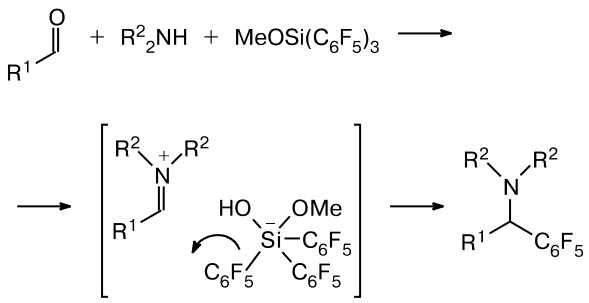
Reactions of tris(pentafluorophenyl)silanes $RSi(C_6F_5)_3$ with salicylaldehyde and secondary amines were studied. The reactions afforded α-pentafluorophenyl-substituted amines. Silanes $RSi(C_6F_5)_3$ (R = Me, Ph, C_6F_5, $CH_2CH{=}CH_2$, and $CH{=}CH_2$) were found to be efficient reagents for transfer of the C_6F_5 group to the iminium cation generated from salicylaldehyde and amine. However, tris(pentafluorophenyl)phenylethynyl- and tris(pentafluorophenyl)silanes were not able to serve as a source of a fluorinated substituent because of competitive transfer of acetylenide fragment or hydride.

Key words: pentafluorophenylsilanes, salicylaldehyde, iminium cation, pentacoordinated silicon, organofluorine compounds, amines, organosilicon compounds.

Amines containing a fluorinated substituent at the α-carbon atom are widely used in pharmaceutical industry and agrochemistry;[1,2] however, the existing methods for preparation of such compounds are very limited.[3,4] Recently, we have proposed to synthesize amines containing a pentafluorophenyl fragment by three-component coupling of aldehydes, amines, and methoxytris(pentafluorophenyl)silane as a source of the C_6F_5 group[5] (Scheme 1).

Scheme 1



R^1 = Ph, 1-naphthyl, 2-furfuryl, Pr^i
$R^2{}_2$ = $(CH_2)_4$, $(CH_2)_5$; R^2 = Et, Bn

However, $MeOSi(C_6F_5)_3$ tends to be hydrolyzed and is difficult to prepare, which puts some limits on the practical feasibility of this procedure. Here we present the results of investigations aimed at searching for more convenient perfluorophenylsilyl derivatives for the synthesis of α-C_6F_5-substituted amines.

As noted earlier,[5] unlike $MeOSi(C_6F_5)_3$, silanes having only methyl and C_6F_5 groups at the Si atom (compounds with the general formula $Me_nSi(C_6F_5)_{4-n}$; n = 1, 2, and 3) are inefficient reagents for three-component coupling with benzaldehyde and secondary amines. We assumed that introduction into an aldehyde molecule of an adjacent hydroxy group capable of binding to a silyl reagent can promote an alternative mechanism, which in turn would allow other C_6F_5-containing silanes to be used. For instance, a reaction of salicylaldehyde with silane is expected to initially give silyl ether **1** (Scheme 2). Its reaction with amine should generate zwitterionic intermediate **2**, which allows intramolecular transfer of the nucleophilic C_6F_5 group from pentacoordinated Si atom to the electrophilic iminium fragment. Hydrolysis of the Si—O bond should finally give amine **3**. At the same time, possible transfer of the other substituent R^1 in intermediate **2** can yield unwanted product **4**. Dihydroxysilanes $(C_6F_5)(R^1)Si(OH)_2$ and $(C_6F_5)_2Si(OH)_2$ formed upon the hydrolysis of the intermediate silyl ethers will either oligomerize through the Si—OH bonds or undergo cleavage of the Si—C_6F_5 bond.

Various pentafluorophenylsilanes were used in coupling reactions with salicylaldehyde (**5**) and pyrrolidine (**6**) as model substrates (Scheme 3). The reactions were carried out in dichloromethane at room temperature. It turned out that amine **3a** is obtained in high yield only with $Si(C_6F_5)_4$ and $MeSi(C_6F_5)_3$; in the reaction with $MeSi(C_6F_5)_3$, no product of methyl transfer was detected. Although the standard reaction time was 16 h, the reaction with $MeSi(C_6F_5)_3$ was completed

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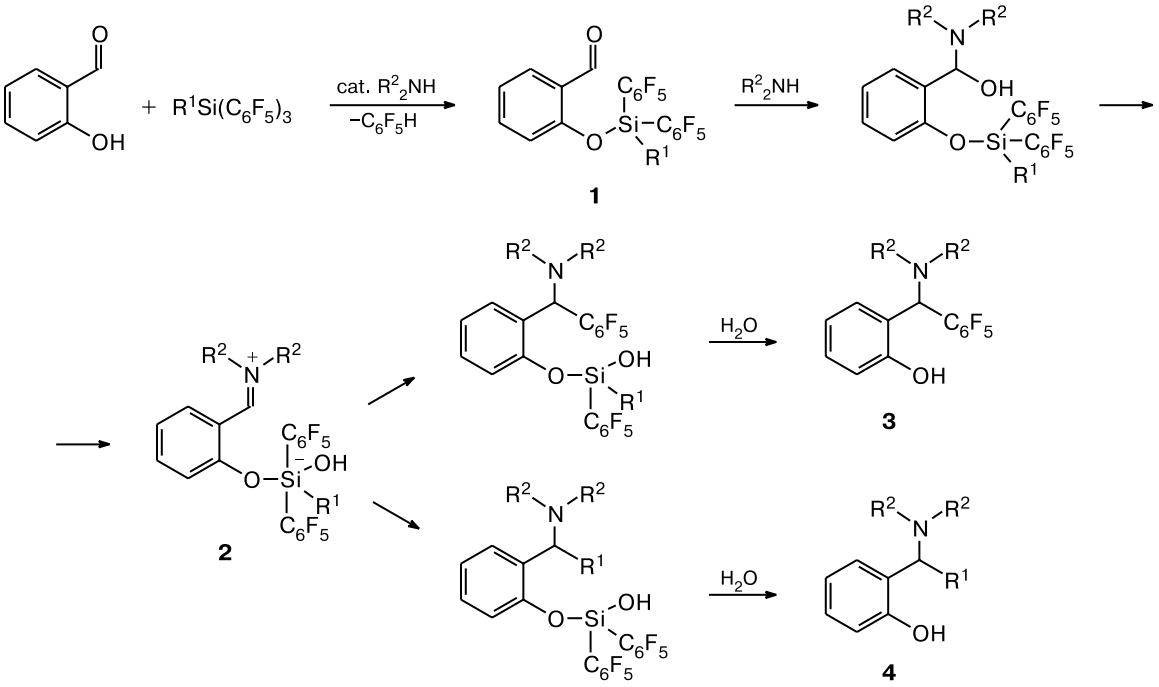
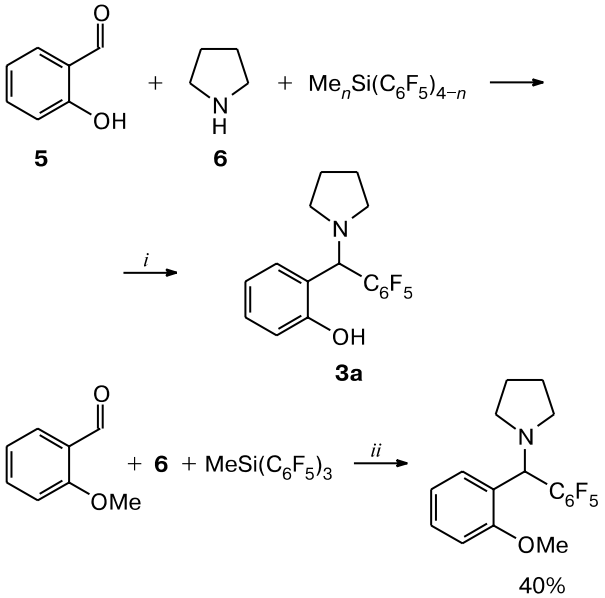
Scheme 2



R^1 = H, Me, Ph, $CH_2CH{=}CH_2$, PhC≡C; R^2 = Et, Bn, $CH_2{=}CHCH_2$; $R^2{}_2$ = $(CH_2)_4$, $(CH_2)_5$

Scheme 3



n	Yield of **3a** (%)	*n*	Yield of **3a** (%)
0	85	2	<5
1	80	3	<5

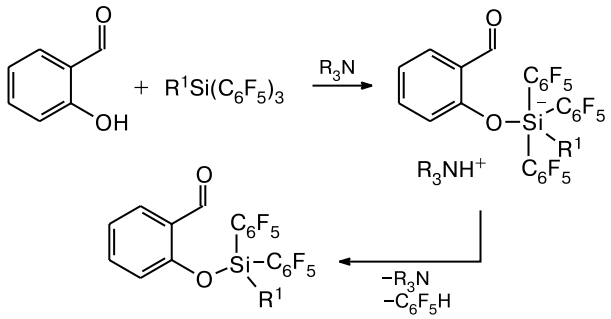
i. CH_2Cl_2, 20 °C, 16 h. *ii*. CH_2Cl_2, 20 °C, 47 h

substantially faster: the yield of amine **3a** was 73% even in 1 h.

One can assume that the influence of the *ortho*-hydroxy group is due to the mesomeric effect. For comparison, we carried out a reaction of $MeSi(C_6F_5)_3$ and pyrrolidine with 2-methoxybenzaldehyde, which cannot form silyl ether **1**. The reaction occurred very slowly and the target product was obtained over 47 h only in 40% yield (Scheme 3). The mechanism shown in Scheme 1 was additionally confirmed by NMR monitoring of a reaction of salicylaldehyde with $MeSi(C_6F_5)_3$ in $CDCl_3$. For instance, in the absence of an amine, the reagents remained unchanged for a long period of time; however, addition of triethylamine resulted in the disappearance of the aldehyde and the formation of pentafluorobenzene (^1H and ^{19}F NMR data). The reaction of salicylaldehyde with silane probably involves deprotonation of the hydroxy group followed by an attack of the aryloxide anion on the Si atom and protonation of the pentacoordinate species at the C_6F_5 group with elimination of pentafluorobenzene (Scheme 4).

We also carried out reactions of other tris(pentafluorophenyl)silyl derivatives with salicylaldehyde under standard conditions (CH_2Cl_2, 20 °C, 16 h). The reaction with a silane containing the phenylethynyl fragment gave a mixture of products due to transfer of both the C_6F_5 group and the phenylacetylenide substituent (Scheme 5). The reaction with the silane $HSi(C_6F_5)_3$ yielded a mixture of three products corresponding to the transfer of the hydride ion and the C_6F_5 group to both the iminium

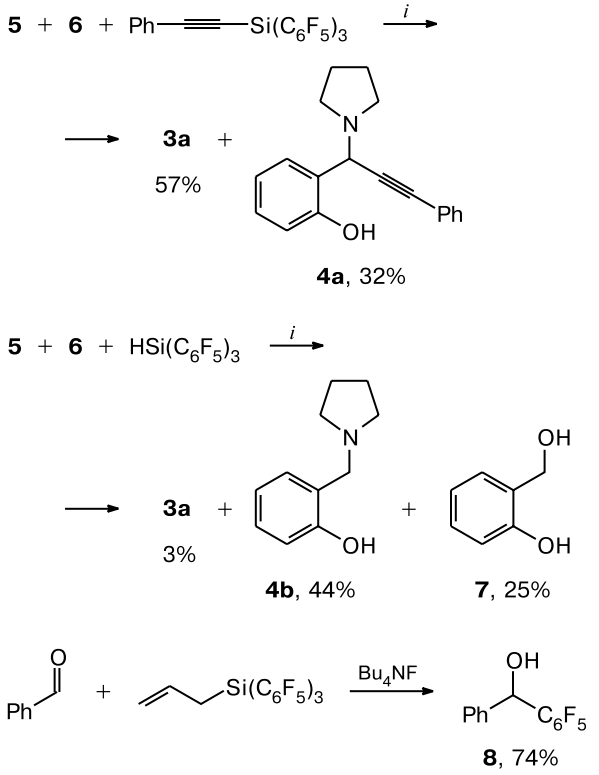
Scheme 4



R^1 = Me, Ph; R_3N = pyrrolidine, NEt_3

cation and salicylaldehyde. The formation of compounds **4a**, **4b**, and **7** is not surprising since it is known that acetylenide and hydride ions in the presence of Lewis bases can be transferred from silicon to an electrophilic site.[6–8]

Scheme 5



i. CH_2Cl_2, 20 °C, 16 h

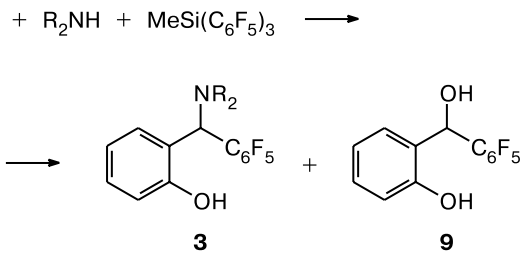
The coupling reactions of CH_2=$CHSi(C_6F_5)_3$, $PhSi(C_6F_5)_3$, and CH_2=$CHCH_2Si(C_6F_5)_3$ with salicylaldehyde and pyrrolidine also gave amine **3a** in 62—84% yield; no products due to transfer of the vinyl, phenyl, and allyl groups were detected. The absence of allylation products in the reaction with CH_2=$CHCH_2Si(C_6F_5)_3$ was absolutely unexpected; indeed, it is known[9] that allylsilanes can serve as efficient allylation reagents, also in base-catalyzed processes involving five-coordinate silicon intermediates. For instance, allyl(trimethyl)silane reacts with benzaldehyde in the presence of tetrabutylammonium fluoride to give the corresponding 1-phenylbut-3-en-1-ol.[10] We carried out an analogous reaction of benzaldehyde with CH_2=$CHCH_2Si(C_6F_5)_3$ and obtained 2,3,4,5,6-pentafluorobenzhydrol (**8**) as the sole product in 74% yield (Scheme 5).

The following conclusion about the relative migrating ability can be drawn from the data obtained: under nucleophilic assistance conditions, a group with the most polar Si—C bond migrates most easily. At the same time, hydrosilanes are more reactive than carbon derivatives, probably because of the low steric requirements of the hydride ion.

From the synthetic viewpoint, the optimum fluorinated silane is $MeSi(C_6F_5)_3$ since this reagent, first, provides a high yield of pentafluorophenyl-containing amine, second, is convenient to handle (water-resistant), third, is easily accessible (prepared in one step from inexpensive precursors[11]), and, fourth, the transfer of the methyl group is highly improbable because the Si—Me bond is only slightly polarized.

Various secondary amines can be involved in the reaction with salicylaldehyde and $MeSi(C_6F_5)_3$ to give three-component coupling products in 38—74% yield (Scheme 6, Table 1). In the case of morpholine, the reaction rate was substantially lower; this is probably associated with the electron-withdrawing effect of the O atom, which destabilizes the iminium cation. However, the reaction accelerated when more polar acetonitrile was used as a solvent. In some cases, diol **9** (~10—15%) was obtained as a by-product due to the transfer of the C_6F_5 group to salicylaldehyde*. In the presence of acetic acid (1 equiv.), this process was appreciably suppressed (<5%).

Scheme 6



Thus, we studied the reactions of pentafluorophenylsilanes with salicylaldehyde and secondary amines and

* A pure sample of diol **9** was obtained from salicylaldehyde and $MeSi(C_6F_5)_3$ in the presence of sodium acetate.

Table 1. Reactions of salicylaldehyde with amines and $MeSi(C_6F_5)_3$

Amine	Conditions[a]	Product	Yield (%)
Morpholine	CH_2Cl_2, 12 days	**3b**	74
	MeCN, 66 h	**3b**	56
Piperidine	MeCN, 16 h	**3c**	70
Et_2NH	MeCN, 12 h[b]	**3d**	64
$(CH_2{=}CHCH_2)_2NH$	MeCN, 7 days[b]	**3e**	57
	MeCN, 21 h[b]	**3e**	47
Bn_2NH	MeCN, 7 days[b]	**3f**	48
	MeCN, 21 h[b]	**3f**	38

[a] At 20 °C.
[b] In the presence of AcOH (1 equiv.).

demonstrated that $MeSi(C_6F_5)_3$ is the optimum starting reagent for the synthesis of amines containing the (2-hydroxyphenyl)(pentafluorophenyl)methyl substituent.

Experimental

^1H, ^{13}C, and ^{19}F NMR spectra were recorded on Bruker AM-300, Bruker WM-250, or Bruker AC-200 instruments in $CDCl_3$. Silanes $RSi(C_6F_5)_3$ (R = Me, Ph, $CH{=}CH_2$, $CH_2CH{=}CH_2$, and $PhC{\equiv}C$) (see Ref. 11) and $HSi(C_6F_5)_3$ (see Ref. 12) were prepared according to known procedures. Commercial salicylaldehyde and secondary amines (Acros and Aldrich) were used. Freshly distilled (over CaH_2) dichloromethane was employed. Acetonitrile was distilled over CaH_2 and kept over molecular sieves (4 Å). Distilled light petroleum (LP, 60—70 °C) and ethyl acetate were used for chromatography.

Reactions of salicylaldehyde with pyrrolidine and $RSi(C_6F_5)_3$ (procedure *A*). Salicylaldehyde (105 μL, 1 mmol) and pyrrolidine (82 μL, 1 mmol) were added at 0 °C to a solution of $RSi(C_6F_5)_3$ (1 mmol) in CH_2Cl_2 (2.6 mL). The reaction mixture was kept at ~20 °C for 16 h. A solution of NH_4F (74 mg, 2 mmol) in MeOH (1.3 mL) and water (0.2 mL) was added at 0 °C. The reaction mixture was allowed to warm, diluted with LP—Et_2O (1 : 1; 10 mL), dried with Na_2SO_4, and filtered. Volatile substances were removed *in vacuo* and the residue was chromatographed on silica gel.

2-[Pentafluorophenyl(pyrrolidin-1-yl)methyl]phenol (3a) (see Ref. 5) was isolated by chromatography in LP—ethyl acetate (18 : 1), R_f 0.31 (LP—ethyl acetate, 10 : 1). Compound **3a** was obtained according to procedure *A* from $Si(C_6F_5)_4$ (85%), $MeSi(C_6F_5)_3$ (80%), $CH_2{=}CHSi(C_6F_5)_3$ (62%), $PhSi(C_6F_5)_3$ (68%), and $CH_2{=}CHCH_2Si(C_6F_5)_3$ (84%).

The reaction with $PhC{\equiv}CSi(C_6F_5)_3$ according to procedure *A* yielded a mixture of products **3a** and **4a**. Chromatography in LP—ethyl acetate (from 20 : 1 to 10 : 1) afforded compounds **3a** (195 mg, 57%) and **4a** (90 mg, 32%).

2-[3-Phenyl-1-(pyrrolidin-1-yl)prop-2-yn-1-yl]phenol (4a), R_f 0.21 (LP—ethyl acetate, 10 : 1), m.p. 73—75 °C (from LP). Found (%): C, 82.39; H, 6.98; N, 5.01. $C_{19}H_{19}NO$ (277.36). Calculated (%): C, 82.28; H, 6.90; N, 5.05. ^1H NMR ($CDCl_3$), δ: 1.87—1.96 (m, 4 H, $(CH_2)_2$); 2.81—2.99 (m, 4 H, 2 CH_2N); 5.31 (s, 1 H, CH); 6.87—6.95 (m, 2 H, CH_{Ar}); 7.26 (td, 1 H, CH_{Ar}, J = 7.7 Hz, J = 1.5 Hz); 7.36—7.43, 7.55—7.62 (both m, 3 H each, CH_{Ar}); 11.02 (s, 1 H, OH). ^{13}C NMR ($CDCl_3$), δ: 23.9 (CH_2); 49.0 and 57.0 (CH and CH_2N); 83.0 and 89.1 (C≡C); 116.3 (CH_{Ar}); 119.0 (CH_{Ar}); 122.2 (C_{Ar}^{ipso}); 122.6 (C_{Ar}^{ipso}); 127.9 (CH_{Ar}); 128.4 (CH_{Ar}); 128.6 (CH_{Ar}); 129.4 (CH_{Ar}); 131.9 (CH_{Ar}); 157.6 ($C_{Ar}OH$).

The reaction of salicylaldehyde with pyrrolidine and $HSi(C_6F_5)_3$ according to procedure *A* gave a mixture of compounds **3a** (3%), **4b** (44%), and **7** (25%). The yields were determined by quantitative ^1H NMR spectroscopy with toluene as a standard. The resulting mixture was dissolved with heating in CCl_4 (2 mL) and kept at room temperature for 24 h. The crystals that formed were filtered off and recrystallized from hexane to give diol **7** (18 mg). The combined filtrates were concentrated and chromatographed on silica gel. Gradient elution in LP—ethyl acetate (from 10 : 1 to 1 : 4), then in ethyl acetate, and finally in ethyl acetate—MeOH (20 : 1) afforded amino phenol **4b** (70 mg).

2-(Pyrrolidin-1-ylmethyl)phenol (4b),[13] R_f 0.37 (LP—ethyl acetate, 1 : 4). ^1H NMR ($CDCl_3$), δ: 1.78—1.90 (m, 4 H, $(CH_2)_2$); 2.56—2.69 (m, 4 H, CH_2N); 3.82 (s, 2 H, CH_2Ar); 6.76 (t, 1 H, CH_{Ar}, J = 7.2 Hz); 6.80 (d, 1 H, CH_{Ar}, J = 7.8 Hz); 6.98 (d, 1 H, CH_{Ar}, J = 7.2 Hz); 7.16 (t, 1 H, CH_{Ar}, J = 7.8 Hz); 10.92 (s, 1 H, OH). ^{13}C NMR ($CDCl_3$), δ: 23.7 ($(CH_2)_2$); 53.5 and 58.9 (CH_2Ar and CH_2N); 115.9 (CH_{Ar}); 118.8 (CH_{Ar}); 122.5 (C_{Ar}^{ipso}); 127.8 (CH_{Ar}); 128.5 (CH_{Ar}); 158.1 ($C_{Ar}OH$).

2-Hydroxymethylphenol (7), m.p. 83—85 °C (from LP) (*cf.* Ref. 14: m.p. 82.5—83.5 °C).

2,3,4,5,6-Pentafluorobenzhydrol (8). A 0.75 *M* solution of Bu_4NF (0.73 mL, 0.55 mmol) in THF was added at −78 °C to a solution of $CH_2{=}CHCH_2Si(C_6F_5)_3$ (311 mg, 0.55 mmol) and benzaldehyde (55 μL, 0.55 mmol) in THF (2 mL). The reaction mixture was kept at −78 °C for 1 h and then at ~20 °C for an additional 1.5 h. Then it was diluted with ether (15 mL) and washed with water (10 mL). The product from the aqueous phase was extracted with ether (2×10 mL). The combined organic phase was dried with $MgSO_4$, filtered through Celite, and concentrated *in vacuo*. The residue was chromatographed on silica gel in LP—ethyl acetate (from 20 : 1 to 5 : 1), R_f 0.10 (LP—ethyl acetate, 15 : 1). The yield of compound **8** was 100 mg (74%), m.p. 42—47 °C (*cf.* Ref. 15: m.p. 49 °C).

Reactions of salicylaldehyde with amines and $MeSi(C_6F_5)_3$ (procedure *B*). Salicylaldehyde (105 μL, 1 mmol) and an amine (1 mmol) were added at 0 °C to a solution of $MeSi(C_6F_5)_3$ (544 mg, 1 mmol) in MeCN (2.6 mL) (in the synthesis of compounds **3d—f**, AcOH (57 μL, 1 mmol) was also added). The reaction mixture was kept at ~20 °C (see Table 1). A saturated solution of Na_2CO_3 (0.3 mL) was added at 0 °C. The reaction mixture was allowed to warm, diluted with LP—Et_2O (1 : 1; 10 mL), dried with Na_2SO_4, and filtered. Volatile substances were removed *in vacuo*. The residue containing products **3** and salicylaldehyde (10—20%) was separated by chromatography.

2-[Morpholino(pentafluorophenyl)methyl]phenol (3b) was obtained according to procedure *B* in CH_2Cl_2 and isolated by chromatography on silica gel in LP—ethyl acetate (from 20 : 1 to 6 : 1). The yield of compound **3b** was 133 mg (74%), R_f 0.20 (LP—ethyl acetate, 6 : 1), m.p. 90—92 °C (from LP). Found (%): C, 56.94; H, 3.91; N, 3.87. $C_{17}H_{14}F_5NO_2$ (359.29). Calculated (%): C, 56.83; H, 3.93; N, 3.90. ^1H NMR ($CDCl_3$), δ: 2.47—2.72 (m, 4 H, $N(CH_2)_2$); 3.81 (t, 4 H, $O(CH_2)_2$, J =

4.6 Hz); 5.31 (s, 1 H, CH); 6.71—6.79 (m, 1 H, CH_{Ar}); 6.81—6.93 (m, 2 H, CH_{Ar}); 7.13—7.22 (m, 1 H, CH_{Ar}); 10.97 (s, 1 H, OH). ^{13}C NMR ($CDCl_3$), δ: 51.4 (CH_2N); 64.3 (CH); 66.7 (CH_2O); 111.4 (tm, $C_{C_6F_5}^{ipso}$, J = 16.0 Hz); 117.2 (CH_{Ar}); 119.4 (C_{Ar}^{ipso}); 119.5 (CH_{Ar}); 128.5 (CH_{Ar}); 129.6 (CH_{Ar}); 137.9 (dm, CF, J = 253 Hz); 141.0 (dm, CF, J = 256 Hz); 145.2 (dm, CF, J = 249 Hz); 156.8 (C_{Ar}—OH). ^{19}F NMR ($CDCl_3$), δ: −161.3 (td, *m*-F, J = 21.5 Hz, J = 8.3 Hz); −154.0 (t, *p*-F, J = 21.5 Hz); −137.9 (br.m, *o*-F, $\Delta\nu_{1/2}$ = 460 Hz).

For efficient separation of compounds **3c—f** from the unreacted salicylaldehyde, the crude product was oximated prior to chromatography: $NH_2OH \cdot HCl$ (35 mg, 0.5 mmol) and AcONa (41 mg, 0.5 mmol) were added to a solution of the crude mixture in MeOH (1 mL). The reaction mixture was kept at room temperature for 30 min, diluted with LP—Et_2O (1 : 1; 10 mL), poured into water (20 mL), and washed with ether (2×15 mL). The combined organic phase was dried with Na_2SO_4 and concentrated *in vacuo*.

2-[Pentafluorophenyl(piperidino)methyl]phenol (3c) was obtained according to procedure ***B*** and isolated by chromatography in LP—ethyl acetate (20 : 1), R_f 0.42 (LP—ethyl acetate, 10 : 1). Found (%): C, 60.48; H, 4.44; N, 3.68. $C_{18}H_{16}F_5NO$ (357.32). Calculated (%): C, 60.50; H, 4.51; N, 3.92. ^1H NMR ($CDCl_3$), δ: 1.41—1.59 (m, 2 H), 1.62—1.81 (m, 4 H), 3 CH_2; 2.54 (br.m, 4 H, 2 CH_2N, $\Delta\nu_{1/2}$ = 22 Hz); 5.42 (s, 1 H, CH); 6.66—6.89 (m, 3 H, CH_{Ar}); 7.16 (t, 1 H, CH_{Ar}, J = 7.5 Hz); 11.78 (s, 1 H, OH). ^{13}C NMR ($CDCl_3$), δ: 23.8 (CH_2); 26.0 (CH_2); 51.7 (br.m, CH_2N, $\Delta\nu_{1/2}$ = 19 Hz); 64.0 (CH); 111.1 (tm, $C_{C_6F_5}^{ipso}$, J = 16.3 Hz); 117.0 (CH_{Ar}); 118.9 (CH_{Ar}); 120.0 (C_{Ar}^{ipso}); 127.9 (CH_{Ar}); 129.2 (CH_{Ar}); 137.8 (dm, CF, J = 252 Hz); 140.8 (dm, CF, J = 256 Hz); 145.2 (dm, CF, J = 245 Hz); 157.6 ($C_{Ar}OH$). ^{19}F NMR ($CDCl_3$), δ: −161.8 (td, *m*-F, J = 21.9 Hz, J = 8.3 Hz); −154.6 (t, *p*-F, J = 21.9 Hz); −141.1 (br.m, *o*-F, $\Delta\nu_{1/2}$ = 340 Hz); −132.6 (br.m, *o*-F, $\Delta\nu_{1/2}$ = 340 Hz).

2-[*N*,*N*-Diethylamino(pentafluorophenyl)methyl]phenol (3d) was obtained according to procedure ***B*** and isolated by chromatography in LP—ethyl acetate (25 : 1), R_f 0.42 (LP—ethyl acetate, 10 : 1). Found (%): C, 59.19; H, 4.71; N, 4.17. $C_{17}H_{16}F_5NO$ (345.31). Calculated (%): C, 59.13; H, 4.67; N, 4.06. ^1H NMR ($CDCl_3$), δ: 1.12—1.35 (t, 6 H, Me, J = 7.1 Hz); 2.35—2.61 (m, 2 H, 2 $C\underline{H}_AH_BN$); 2.79—3.02 (m, 2 H, 2 $CH_A\underline{H}_BN$); 5.75 (s, 1 H, CH); 6.68—6.95 (m, 3 H, CH_{Ar}); 7.13—7.24 (m, 1 H, CH_{Ar}); 11.80 (s, 1 H, OH). ^{13}C NMR ($CDCl_3$), δ: 11.6 (Me); 43.3 (CH_2); 59.3 (CH); 111.3 (tm, $C_{C_6F_5}^{ipso}$, J = 16.6 Hz); 117.0 (CH_{Ar}); 119.0 (CH_{Ar}); 120.5 (C_{Ar}^{ipso}); 127.9 (CH_{Ar}); 129.2 (CH_{Ar}); 137.9 (dm, CF, J = 253 Hz); 140.9 (dm, CF, J = 256 Hz); 145.7 (dm, CF, J = 243 Hz); 157.8 ($C_{Ar}OH$). ^{19}F NMR ($CDCl_3$), δ: −161.6 (td, *m*-F, J = 21.8 Hz, J = 6.9 Hz); −154.4 (t, *p*-F, J = 21.8 Hz); −136.0 (br.m, *o*-F, $\Delta\nu_{1/2}$ = 1400 Hz).

2-[*N*,*N*-Diallylamino(pentafluorophenyl)methyl]phenol (3e) was obtained according to procedure ***B*** and isolated by chromatography in LP—ethyl acetate (10 : 1), R_f 0.79 (LP—ethyl acetate, 3 : 1). Found (%): C, 61.84; H, 4.46; N, 3.52. $C_{19}H_{16}F_5NO$ (369.33). Calculated (%): C, 61.79; H, 4.37; N, 3.79. ^1H NMR ($CDCl_3$), δ: 3.04 (dd, 2 H, 2 $C\underline{H}_AH_BN$, J = 14.0 Hz, J = 7.4 Hz); 3.47 (dd, 2 H, 2 $CH_A\underline{H}_BN$, J = 14.0 Hz, J = 5.9 Hz); 5.13—5.31 (m, 4 H, CH=$C\underline{H}_2$); 5.71 (s, 1 H, CHN); 5.83—5.99 (m, 2 H, $C\underline{H}$=CH_2); 6.70—6.83 (m, 2 H, CH_{Ar}); 6.88 (d, 1 H, CH_{Ar}, J = 8.5 Hz); 7.19 (t, 1 H, CH_{Ar}, J = 7.5 Hz); 11.23 (s, 1 H, OH). ^{13}C NMR ($CDCl_3$), δ: 52.9 (CH_2); 59.5 (CH); 111.5 (tm, $C_{C_6F_5}^{ipso}$, J = 16.8 Hz); 117.2 (CH_{Ar}); 119.3 (CH_{Ar}); 120.1 (CH_2=); 120.3 ($C_{i\text{-}Ar}$); 128.1 (CH_{Ar}); 129.5 (CH_{Ar}); 132.8 (CH=); 137.9 (dm, CF, J = 253 Hz); 141.0 (dm, CF, J = 256 Hz); 145.6 (dm, CF, J = 244 Hz); 157.4 ($C_{Ar}OH$). ^{19}F NMR ($CDCl_3$), δ: −161.4 (td, *m*-F, J = 21.1 Hz, J = 6.9 Hz); −153.6 (t, *p*-F, J = 21.1 Hz); −134.6 (br.m, *o*-F, $\Delta\nu_{1/2}$ = 200 Hz).

2-[*N*,*N*-Dibenzylamino(pentafluorophenyl)methyl]phenol (3f) was obtained according to procedure ***B*** and isolated by chromatography in LP—ethyl acetate (10 : 1), R_f 0.33 (LP—ethyl acetate, 4 : 1). Found (%): C, 68.91; H, 4.47; N, 2.71. $C_{27}H_{20}F_5NO$ (469.45). Calculated (%): C, 69.08; H, 4.29; N, 2.98. ^1H NMR ($CDCl_3$), δ: 3.58 (d, 2 H, 2 $C\underline{H}_AH_BN$, J = 13.4 Hz); 4.00 (d, 2 H, 2 $CH_A\underline{H}_BN$, J = 13.4 Hz); 5.80 (s, 1 H, CH); 6.81—6.92 (m, 2 H, CH_{Ar}); 7.05 (d, 1 H, CH_{Ar}, J = 7.7 Hz); 7.26—7.47 (m, 11 H, CH_{Ar}); 11.30 (s, 1 H, OH). ^{13}C NMR ($CDCl_3$), δ: 55.2 (CH_2); 59.6 (CH); 111.0 (tm, $C_{C_6F_5}^{ipso}$, J = 16.6 Hz); 117.2 (CH_{Ar}); 119.5 (CH_{Ar}); 120.4 (C_{Ar}^{ipso}); 127.9 (CH_{Ar}); 128.2 (CH_{Ar}); 128.7 (CH_{Ar}); 129.5 (CH_{Ar}); 129.7 (CH_{Ar}); 136.5 (C_{Ar}^{ipso}); 138.0 (dm, CF, J = 253 Hz); 141.1 (dm, CF, J = 256 Hz); 145.6 (dm, CF, J = 246 Hz); 157.1 ($C_{Ar}OH$). ^{19}F NMR ($CDCl_3$), δ: −161.4 (td, *m*-F, J = 21.5 Hz, J = 7.6 Hz); −153.6 (t, *p*-F, J = 21.5 Hz); −134.6 (br.m, *o*-F, $\Delta\nu_{1/2}$ = 190 Hz).

2′-Hydroxy-2,3,4,5,6-pentafluorobenzhydrol (9). A mixture of $MeSi(C_6F_5)_3$ (544 mg, 1 mmol), salicylaldehyde (105 μL, 1 mmol), and sodium acetate (98 mg, 1.2 mmol) in THF (2 mL) was refluxed for 2 h. A solution of NH_4F (74 mg, 2 mmol) in MeOH (1.3 mL) and water (0.2 mL) was added at 0 °C. The mixture was allowed to warm, diluted with Et_2O (10 mL), dried with Na_2SO_4, and filtered. Volatile substances were removed *in vacuo*. The residue was chromatographed on silica gel in LP—ethyl acetate (from 10 : 1 to 4 : 1), R_f 0.16 (LP—ethyl acetate, 3 : 1). The yield of compound **9** was 247 mg (85%), m.p. 74—77 °C (from LP). Found (%): C, 53.94; H, 2.27. $C_{13}H_7F_5O_2$ (290.19). Calculated (%): C, 53.81; H, 2.43. ^1H NMR ($CDCl_3$), δ: 6.47 (s, 1 H, CH); 6.84 (d, 1 H, CH_{Ar}, J = 8.1 Hz); 6.89 (d, 1 H, CH_{Ar}, J = 7.7 Hz); 6.96 (d, 1 H, CH_{Ar}, J = 7.7 Hz); 7.21 (t, 1 H, CH_{Ar}, J = 7.9 Hz). ^{13}C NMR ($CDCl_3$), δ: 66.8 (CH); 115.6 (tm, $C_{C_6F_5}^{ipso}$, J = 16.3 Hz); 116.9 (CH_{Ar}); 120.6 (CH_{Ar}); 123.9 (C_{Ar}^{ipso}); 126.8 (CH_{Ar}); 129.8 (CH_{Ar}); 137.7 (dm, CF, J = 254 Hz); 141.0 (dm, CF, J = 259 Hz); 144.8 (dm, CF, J = 246 Hz); 154.2 (C_{Ar}—OH). ^{19}F NMR ($CDCl_3$), δ: −162.4 (td, *m*-F, J = 21.1 Hz, J = 6.9 Hz); −155.0 (t, *p*-F, J = 21.1 Hz); −143.3 (dd, *o*-F, J = 21.1 Hz, J = 6.9 Hz).

1-[(2-Methoxyphenyl)(pentafluorophenyl)methyl]pyrrolidine was obtained from 2-methoxybenzaldehyde according to procedure ***B*** (40 h) in CH_2Cl_2 and isolated by chromatography in LP—ethyl acetate (27 : 1), R_f 0.37 (LP—ethyl acetate, 10 : 1). The yield was 284 mg (40%). Found (%): C, 60.37; H, 4.46; N, 3.98. $C_{18}H_{16}F_5NO$ (357.32). Calculated (%): C, 60.50; H, 4.51; N, 3.92. ^1H NMR ($CDCl_3$), δ: 1.79—1.89 (m, 4 H, $(CH_2)_2$); 2.32—2.42 (m, 2 H, 2 $C\underline{H}_AH_BN$); 2.62—2.73 (m, 2 H, 2 $CH_A\underline{H}_BN$); 3.76 (d, 3 H, OCH_3, J = 1.5 Hz); 5.15 (s, 1 H, CH); 6.81 (d, 1 H, CH_{Ar}, J = 8.7 Hz; J = 7.0 Hz) (t, 1 H, CH_{Ar}, J = 7.5 Hz); 7.20—7.25, 7.84—7.90 (both m, 1 H each, CH_{Ar}). ^{13}C NMR ($CDCl_3$), δ: 23.6 (CH_2); 53.6 (CH_2N); 55.1 and 57.6 (CH and OMe); 110.1 (CH_{Ar}); 116.5 (tm, $C_{C_6F_5}^{ipso}$, J = 16.7 Hz); 120.3 (CH_{Ar}); 127.9 (C_{Ar}^{ipso}); 128.3 (CH_{Ar}); 129.3 (CH_{Ar}); 137.4 (dm, CF, J = 251 Hz); 140.3 (dm, CF, J = 258 Hz); 145.4 (dm, CF, J = 250 Hz); 156.6 (C_{OMe}^{ipso}). ^{19}F NMR ($CDCl_3$), δ: −164.4 (td, *m*-F, J = 21.2 Hz, J = 6.9 Hz); −158.2 (t, *p*-F, J = 21.2 Hz); −141.0 (br.d, *o*-F).

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