Synthesis of 3-alkylamino-3-(2-hydroxyaryl)-1-polyfluoroalkylprop-2-en-1-ones and 2-polyfluoroalkyl-4*H*-chromen-4-imines

V. Ya. Sosnovskikh and B. I. Usachev*

A. M. Gor´kii Ural State University,
51 prosp. Lenina, 620083 Ekaterinburg, Russian Federation.
Fax: +7 (343 2) 61 5978. E-mail: vyacheslav.sosnovskikh@usu.ru

Condensation of Schiff´s bases (prepared from 2-hydroxy- or 2-hydroxy-5-methylacetophenones and primary amines) with ethyl polyfluoroalkanoates in the presence of LiH in THF affords 3-alkylamino-3-(2-hydroxyaryl)-1-polyfluoroalkylprop-2-en-1-ones, which undergo cyclization in acidic media into 2-polyfluoroalkyl-4*H*-chromen-4-iminium salts. When neutralized with aqueous ammonia, the latter give 2-polyfluoroalkyl-4*H*-chromen-4-imines in high yields.

Key words: Schiff´s bases, polyfluoroalkanoic acid esters, amino enones, 2-polyfluoroalkyl-4*H*-chromen-4-imines and their salts.

Chromones (4*H*-chromen-4-ones) represent an important class of oxygen-containing heterocyclic moieties of flavonoids, which are abundant plant constituents.[1] Many chromone derivatives have been thoroughly studied[1,2] and found wide use as drugs.[3] However, data on the synthesis and chemical properties of 4*H*-chromen-4-ylideneamines (4*H*-chromen-4-imines) are scarce. Earlier,[4] it was shown that Schiff´s bases prepared from 2-hydroxyacetophenone and alkylamines react with arenecarboxylates in the presence of Pr^i_2NLi to give 3-alkylamino-3-(2-hydroxyphenyl)-1-arylprop-2-en-1-ones, which undergo cyclization into *N*-substituted 2-aryl-4*H*-chromen-4-imines when heated with AcOH in aqueous THF. In addition, alkyl methyl ketimines were known[5] to react with alkyl trifluoroacetates under analogous conditions to give 3-alkyl-3-alkylamino-1-trifluoromethylprop-2-en-1-ones. Based on these data, we recently[6,7] obtained for the first time 2-trifluoromethyl-4*H*-chromen-4-imines by condensation of 2-hydroxyacetophenone imines with ethyl trifluoroacetate *via* intermediate 3-alkylamino-3-(2-hydroxyphenyl)-1-trifluoromethylprop-2-en-1-ones. In acidic media, these compounds are more reactive with respect to N- and C-nucleophiles than 2-trifluoromethylchromones[2] and were used as starting reagents for the synthesis of 4(5)-salicyloyl-5(4)-trifluoromethyl-1,2,3-triazoles[6] and 2-methyl-2-trifluoromethylchroman-4-ones[7], which could not be obtained from the corresponding chromones. The higher reactivities of 2-trifluoromethylchromenimines are probably due to the fact that they, as rather strong bases, are protonated at the imino N atom even in the presence of AcOH to generate iminium cations with the enhanced electrophilicity of the C(2) atom,[8] which is usually attacked first in the reaction of a chromone system with nucleophiles.[9] In most cases, the latter circumstance makes it impossible to directly convert chromones into chromenimines, except for the reactions of 2-R^F-chromones with 2-aminoethanol for $R^F = (CF_2)_2H$ and C_2F_5, which involves the carbonyl group to give the corresponding imines.[8] The present study is devoted to the reactions of Schiff´s bases prepared from 2-hydroxy- and 2-hydroxy-5-methylacetophenones with ethyl polyfluoroalkanoates and aimed at developing a general route to 2-polyfluoroalkyl-4*H*-chromen-4-imines, which are of interest as promising and highly reactive substrates for the synthesis of various polyfluoroalkyl-containing heterocyclic compounds.

Results and Discussion

Ketimines **1a—e** were obtained in 58—94% yields by the reactions of benzylamine, isopropylamine, and 2-aminoethanol with 2-hydroxy- and 2-hydroxy-5-methylacetophenones. Primary amines were reported[10] to easily react with aromatic aldehydes and ketones containing an *ortho*-OH group, probably because of thermodynamic stabilization of reaction products by a strong intramolecular hydrogen bond (IMHB) with the azomethine N atom. We found that the condensation of imines **1a—e** with CF_3CO_2Et and $H(CF_2)_2CO_2Et$ in the presence of LiH in boiling THF affords amino enones **2a—e** and **2f—i** in 51—82% and 11—38% yields, respectively. The use of ethyl difluoroacetate and ethyl trichloroacetates under analogous conditions leads to resinification. Treatment of compounds **2a—i** with ethanolic HCl at ≈20 °C for 2 h gives chromeniminium chlorides **3a—i**; salt **3e** was isolated and characterized as a monohydrate. Neutraliza-

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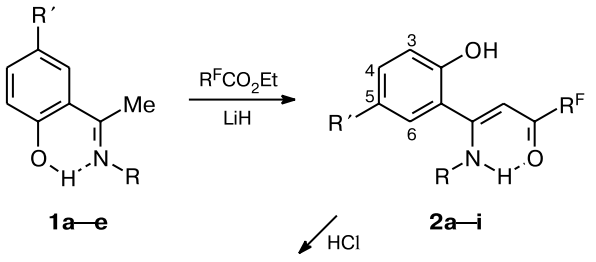
tion of aqueous solutions of hydrochlorides **3a**—**i** with ammonia affords chromenimines **4a**—**i** in 63—91% yields (Scheme 1).

Scheme 1



1a—e **2a—i** **3a—i** **4a—i**

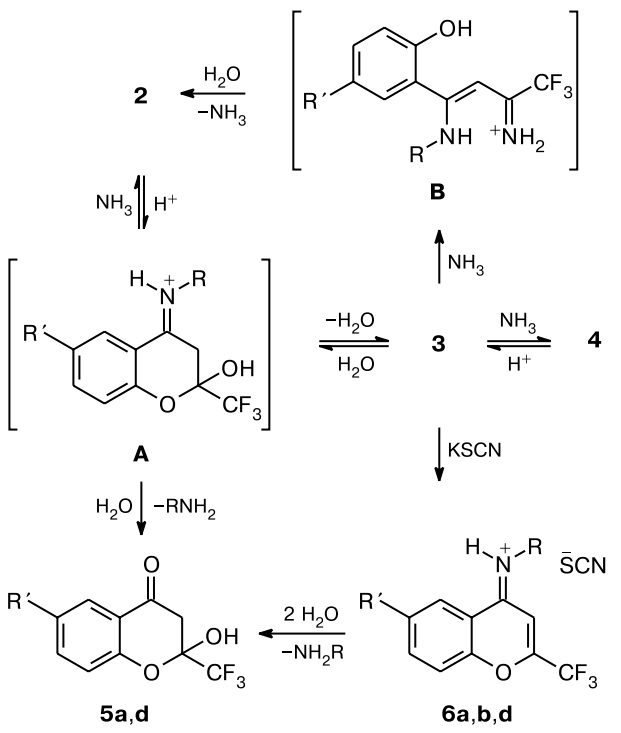
1—4	R	R′	2—4	R	R′
a	CH_2Ph	H	**f**	CH_2Ph	H
b	Pr^i	H	**g**	Pr^i	H
c	$(CH_2)_2OH$	H	**h**	$(CH_2)_2OH$	H
d	CH_2Ph	Me	**i**	CH_2Ph	Me
e	$(CH_2)_2OH$	Me			

2—4: $R^F = CF_3$ (**a**—**e**), $(CF_2)_2H$ (**f**—**i**)

In some cases, the crude products contained admixtures of amino enones **2**, which are insoluble in hot hexane and thus can easily be separated from the target chromenimines **4**. To answer the question as to whether this impurity is the non-consumed amino enone **2** or it is produced by the base-catalyzed competitive opening of the pyrone ring in chromeniminium cation **3**, we studied the hydrolysis of trifluoromethylated compounds **2a**,**b**,**d** and **4a**,**b**,**d** under various conditions. It turned out that treatment of chromenimines **4** with aqueous AcOH at ≈20 °C for 12 h (or at 80 °C for 1 h) gives chromanones **5**, which were also obtained from compounds **2** under analogous conditions. However, treatment of compounds **4** with aqueous AcOH and $AcONH_4$ results in fast formation of amino enones **2**. Therefore, during the isolation of compounds **4** from solutions of their salts, neutralization is accompanied by side opening of the pyrone ring, which accounts for the presence of **2** as an impurity. To minimize the probability of this undesired reaction, ammonia should be used in a slight excess and added in one portion, because chromenimines **4** are fairly stable in basic media.

The data obtained suggest that the interconversions of compounds **2** and **4** and their hydrolysis to chromanones **5** proceed *via* the same intermediate **A**, while further conversions of the latter mainly depend on pH (Scheme 2). Apparently, the rapid conversion **4** → **2** involves the open enaminoiminium cation **B** since enaminoimines themselves are easily hydrolyzed to amino enones with the γ-arrangement of the RHN- and trihalogenomethyl groups[11] as in compounds **2**. Note also that enamino ketones **2** containing no *ortho*-OH group are resistant to hydrolysis, whereas their regioisomers with the α-arrangement of the RHN- and R^F groups are hydrolyzed to β-diketones under mild conditions.[5] The pyrone ring of 2-trifluoromethylchromones easily undergoes opening in the presence of NH_3,[12] but does not add water at the activated C=C bond; *i.e.*, 2-trifluoromethylchromen-4-imines are actually more reactive than 2-trifluoromethylchromones in acidic media and hence are attractive building blocks for the synthesis of various trifluoromethylated heterocyclic compounds.

Scheme 2



A **B**

R = CH_2Ph (**6a**, **6d**), Pr^i (**6b**); R′ = H (**5a**, **6a**, **6b**), Me (**5d**, **6d**)

Treatment of chromenimines **4a**,**b**,**d** with potassium thiocyanate in aqueous acetic acid gives thiocyanates **6a**,**b**,**d**. Being poorly soluble in water, these salts are soluble in most organic solvents, which can be of interest for their reactions in anhydrous media. When heated in aqueous AcOH, thiocyanates **6**, like compounds **2** and **4**, are hydrolyzed to chromanones **5** (see Scheme 2).

Recently,[13] the condensation of khellinone (5-acetyl-6-hydroxy-4,7-dimethoxybenzo[*b*]furan) with CF_3CO_2Et

afforded 7-trifluoromethylnorkhellin **7a**. This is a fluorinated analog of a natural furochromone, namely, khellin **7b**, which is an effective medicine[3] contained in the plant *Ammi visnaga L* known for its medical properties since the times of ancient Egyptians.[14] Substitution of a CF_3 group for the methyl group in khellin **7b** significantly redistributes the electron density in the heterocyclic system, which makes 7-trifluoromethylnorkhellin **7a** a promising substrate for the synthesis of biologically active substances.[15] Its synthetic value could increase significantly by replacing the carbonyl O atom by an =N—R group. As expected, an attempt to synthesize furochromenimines by direct reactions of khellins **7a**,**b** with 2-aminoethanol failed since in both cases the C(7) atom is involved and the pyrone ring undergoes opening to give amino enones **8a**,**b** of the benzofuran series (Scheme 3). Note that in a solution of $CDCl_3$, amino enone **8a** experiences ring—chain tautomerism and exists as an equilibrium 1 : 1 mixture of open and oxazolidine forms. With other primary amines, 2-trifluoromethylchromones and khellin **7b** react analogously.[12,16] To replace the carbonyl group in compound **7a** by an imino group, we used the approach described above; for this purpose, khellinone imine **9** was synthesized from khellinone and 2-aminoethanol. Condensation of compound **9** with CF_3CO_2Et under the conditions used for the condensation of imines **1** afforded 58% of amino enone **10**, which is a regioisomer of amino enone **8a**. However, the corresponding furochromenimine was not obtained from it because the starting amino enone **10** was recovered after the reaction mixture was treated with HCl and neutralized with ammonia, while an attempt to isolate hydrochloride **11** afforded a mixture of compounds **10** and **11** in a 3 : 1 ratio (^{1}H NMR data). These data indicate that chromenimines are difficult to prepare from amino enones containing an *ortho*-substituent relative to the enamino group. Apparently, this is due to unfavorable steric interactions of this substituent with the H atom of the iminium group in the cyclization product (Scheme 3).

It is known[17] that aryl methyl ketimines containing no *ortho*-substituent exist in $CDCl_3$ as an equilibrium mixture of *Z*- and *E*-isomers (the content of the latter is 93—98%), while introduction of a Me or MeO group into the *ortho*-position shifts the equilibrium to the *Z*-isomer. Compounds **1a**—**e** and **9** with the *ortho*-OH group are stabilized by the strong IMHB between the phenolic OH group and the imine N atom (δ_{OH} = 15.8—16.9); as a result, the ^{1}H NMR spectra of these imines show only one set of signals corresponding to the *E*-isomer (Table 1).

In contrast to imines **1**, the signal for the phenolic proton in amino enones **2** is shifted upfield (δ 4.8—5.8 in $CDCl_3$ and δ 10.0—10.4 in DMSO-d_6). This signal disappears upon addition of CD_3CO_2D, which is characteristic of an OH group not involved in intramolecular hydrogen bonding. The low-field signal for the NH proton (δ 11.1—11.5) in both $CDCl_3$ and DMSO-d_6 (see Table 1) precludes assignment of the alternative cyclic structure **2′** to the condensation products of imines **1** and R^FCO_2Et and suggests the *Z*-configuration of the double bond in amino enones **2**, which is stabilized by a strong IMHB (N—H···O=C). Apparently, the *ortho*-hydroxyphenyl substituent in compounds **2** is not involved in the IMHB with the N atom and is noncoplanar with the amino enone fragment because of unfavorable steric effects. This is confirmed by the chemical shifts of the OH and H(6) protons in amino enones **2a**,**c**,**f** and their isomers **12a**,**c**,**f** obtained by us earlier[8,12,18] (Scheme 4; averaged ^{1}H chemical shifts ($CDCl_3$, δ_H) are indicated; the signals for the aromatic protons were assigned using the available data[19,20]).

Scheme 3

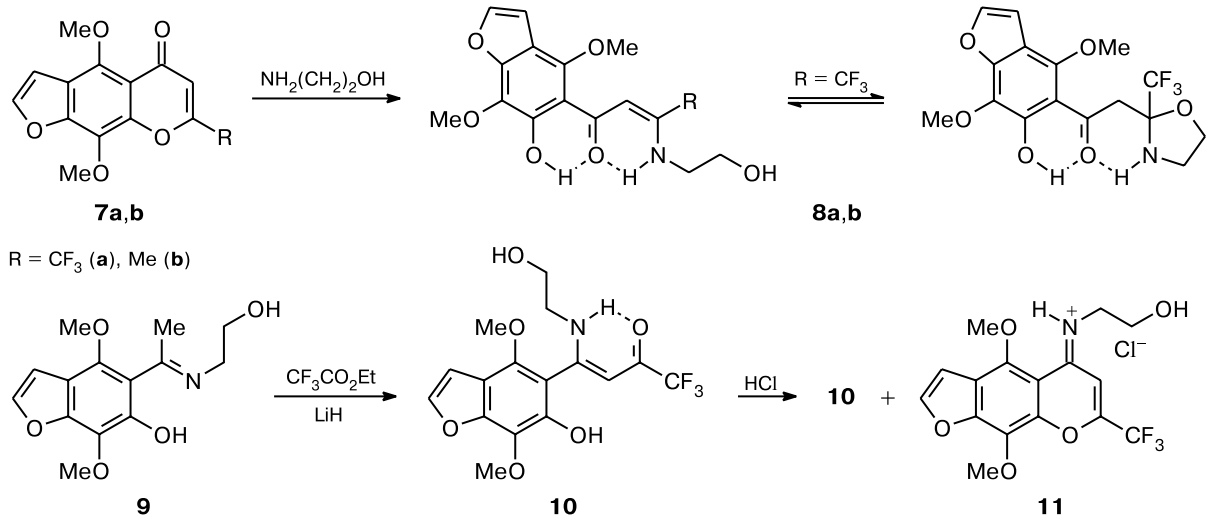


Table 1. ^{1}H NMR and IR spectra of imines **1a—e** and amino enones **2a—i**

Compound	^{1}H NMR, δ (*J*/Hz)								IR, ν/cm^{-1}
	=CH	H(3)	H(4)	H(5)	H(6)	OH	NH	R, R^F	
1a[a]	—	6.93 (dd, J_o = 8.3, J_m = 1.1)	7.29 (ddd, J_o = 8.6, J_o = 7.1, J_m = 1.7)	6.79 (ddd, J_o = 8.2, J_o = 7.2, J_m = 1.3)	7.55 (dd, J_o = 8.0, J_m = 1.6)	16.26 (s)	—	2.41 (s, Me); 4.80 (s, CH_2); 7.26—7.36 (m, Ph)	1620, 1575, 1500
1b[a]	—	6.90 (dd, J_o = 8.3, J_m = 1.1)	7.26 (ddd, J_o = 8.6, J_o = 7.1, J_m = 1.7)	6.73 (ddd, J_o = 8.2, J_o = 7.2, J_m = 1.2)	7.48 (dd, J_o = 8.0, J_m = 1.6)	16.9 (br.s)	—	2.36 (s, Me); 1.31 (d, 2 Me, J = 6.3); 3.98 (septet, CH, J = 6.3)	1615, 1585, 1510
1c[a]	—	6.90 (dd, J_o = 8.3, J_m = 1.1)	7.27 (ddd, J_o = 8.6, J_o = 7.2, J_m = 1.7)	6.74 (ddd, J_o = 8.2, J_o = 7.2, J_m = 1.2)	7.48 (dd, J_o = 8.0, J_m = 1.6)	2.4 (br.s)[b]; 16.2 (br.s)[c]	—	2.35 (s, Me); 3.72 (t, CH_2N, J = 5.3); 3.98 (t, CH_2O, J = 5.3)	3150, 1610, 1540
1d[a]	—	6.85 (d, J_o = 8.4)	7.11 (dd, J_o = 8.4, J_m = 2.0)	2.30 (s, Me)	7.29 (d, J_m = 1.6)	16.0 (br.s)	—	2.40 (s, Me); 4.79 (s, CH_2); 7.25—7.36 (m, Ph)	1625, 1580, 1500
1e[a]	—	6.83 (d, J_o = 8.4)	7.10 (dd, J_o = 8.4, J_m = 2.1)	2.29 (s, Me)	7.29 (d, J_m = 1.6)	2.0 (br.s)[b]; 15.8 (br.s)[c]	—	2.35 (s, Me); 3.72 (t, CH_2N, J = 5.4); 3.98 (t, CH_2O, J = 5.4)	3150, 1625, 1530
2a[a]	5.49 (s)	6.93 (dd, J_o = 8.2, J_m = 0.7)	7.34 (ddd, J_o = 8.2, J_o = 7.5, J_m = 1.7)	6.99 (ddd,[d] J_o = 7.6, J_o = 7.5, J_m = 1.0)	7.18 (dd, J_o = 7.6, J_m = 1.6)	4.8 (br.s)	11.4 (br.s)	4.42 (br.s, CH_2); 7.14—7.31 (m, Ph)	3165, 1610, 1565
2a[e,f]	5.29 (s)	7.00 (d, J_o = 8.2)	—[g]	6.90 (t, J_o = 7.5)	—[g]	10.4 (br.s)	11.42 (t, J = 5.4)	4.45 (d, CH_2, J = 5.4); 7.14—7.40 (m, Ph)	—
2b[a]	5.37 (s)	6.96 (dd, J_o = 8.2, J_m = 0.8)	7.36 (ddd, J_o = 8.2, J_o = 7.5, J_m = 1.7)	7.01 (ddd,[d] J_o = 7.6, J_o = 7.5, J_m = 1.0)	7.17 (dd, J_o = 7.6, J_m = 1.7)	5.7 (br.s)	11.1 (br.s)	1.21 (br.s, 2 Me); 3.63 (d.septet, CH, $J_{CH,NH}$ = 9.6, $J_{CH,Me}$ = 6.5)	3205, 1620, 1585
2b[e,f]	5.14 (s)	6.92 (d, J_o = 8.2)	7.33 (ddd, J_o = 8.2, J_o = 7.5, J_m = 1.6)	6.89 (t, J_o = 7.5)	7.19 (dd, J_o = 7.6, J_m = 1.6)	10.21 (s)	11.15 (d, J = 9.3	1.13 (d, 2 Me, J = 6.4); 3.52 (d.septet, CH, $J_{CH,NH}$ = 9.7, $J_{CH,Me}$ = 6.4); −76.53 (s, CF_3)[h]	—
2c[a,i]	5.45 (s)	6.96 (d, J_o = 8.2)	7.37 (ddd, J_o = 8.2, J_o = 7.5, J_m = 1.7)	7.03 (t, J_o = 7.5)	7.19 (dd, J_o = 7.6, J_m = 1.6)	2.0 (br.s)[b]; 5.3 (br.s)[c]	11.3 (br.s)	3.42 (br.s, CH_2N); 3.80 (t, CH_2O, J = 5.2)	3290, 3220, 1610, 1560
2c[e,f]	5.22 (s)	6.95 (d, J_o = 8.2)	7.33 (t, J_o = 7.8)	6.91 (t, J_o = 7.5)	7.20 (d, J_o = 7.6)	5.0 (br.s)[b]; 10.2 (br.s)[c]	11.31 (t, J = 5.4)	3.25 (q, CH_2N, J = 5.4); 3.49 (t, CH_2O, J = 5.4)	—
2d[a]	5.48 (s)	6.83 (d, J_o = 8.3)	7.15 (dd, J_o = 8.3, J_m = 1.6)	2.29 (s, Me)	6.96 (d, J_m = 1.8)	5.6 (br.s)	11.4 (br.s)	4.42 (br.s, CH_2); 7.16—7.33 (m, Ph)	3220, 1625, 1590, 1565, 1510

(*to be continued*)

Table 1 (*continued*)

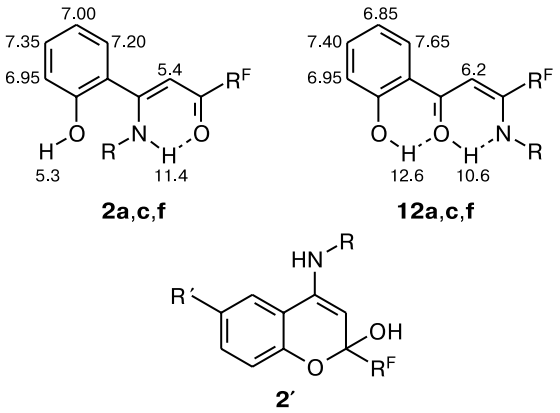
Compound	^{1}H NMR, δ (*J*/Hz)								IR, ν/cm^{-1}
	=CH	H(3)	H(4)	H(5)	H(6)	OH	NH	R, R^F	
2e[e]	5.22 (s)	6.85 (d, J_o = 8.3)	7.14 (ddq, J_o = 8.3, J_m = 2.2, $^4J_{H,CH_3}$ = 0.6)	2.23 (s, Me)	7.01 (d, J_m = 2.0)	5.0 (br.s)[b]; 10.0 (br.s)[c]	11.32 (t, J = 5.6)	3.27 (br.s, CH_2N); 3.50 (t, CH_2O, J = 5.1)	3225, 1620, 1570
2f[a]	5.59 (s)	6.94 (d, J_o = 8.2)	7.36 (ddd, J_o = 8.2, J_o = 7.5, J_m = 1.6)	7.01 (ddd,[d] J_o = 7.6, J_o = 7.5, J_m = 0.8)	7.20 (dd, J_o = 7.6, J_m = 1.6)	5.8 (br.s)	11.5 (br.s)	4.41 (br.s, CH_2); 7.16—7.33 (m, Ph); 6.11 (tt, CF_2CF_2H, ^2J = 53.2, ^3J = 5.3)	3205, 1615, 1560
2f[e]	5.31 (s)	7.00 (d, J_o = 8.2)	7.36 (ddd, J_o = 8.2, J_o = 7.5, J_m = 1.7)	6.92 (ddd,[d] J_o = 7.6, J_o = 7.5, J_m = 0.9)	7.19 (dd, J_o = 7.6, J_m = 1.7)	10.35 (s)	11.45 (t, J = 6.1)	4.43 (br.s, CH_2); 7.20—7.34 (m, Ph); 6.69 (tt, CF_2CF_2H, ^2J = 51.9, ^3J = 5.8)	—
2g[a]	5.46 (t, $J_{H,F}$ = 1.2)	6.95 (dd, J_o = 8.2, J_m = 0.7)	7.36 (ddd, J_o = 8.2, J_o = 7.5, J_m = 1.7)	7.01 (ddd,[d] J_o = 7.6, J_o = 7.5, J_m = 1.0)	7.18 (dd, J_o = 7.6, J_m = 1.6)	5.3 (br.s)	11.2 (br.s)	1.21 (d, 2 Me, J = 5.4); 3.63 (d.septet, CH, $J_{CH,NH}$ = 9.6, $J_{CH,Me}$ = 6.5); 6.12 (tt, CF_2CF_2H, ^2J = 53.2, ^3J = 5.4)	3200, 1620, 1575
2h[a]	5.54 (t, $J_{H,F}$ = 1.2)	6.96 (dd, J_o = 8.2, J_m = 0.7)	7.36 (ddd, J_o = 8.2, J_o = 7.5, J_m = 1.7)	7.02 (ddd,[d] J_o = 7.6, J_o = 7.5, J_m = 1.0)	7.19 (dd, J_o = 7.6, J_m = 1.6)	3.6 (br.s)[b]; 3.6 (br.s)[c]	11.4 (br.s)	3.42 (br.s, CH_2N); 3.79 (t, CH_2O, J = 5.2); 6.10 (tt, CF_2CF_2H, ^2J = 53.2, ^3J = 5.3)	3120, 1620, 1570
2i[a]	5.57 (s)	6.81 (d, J_o = 8.3)	7.12 (dd, J_o = 8.3, J_m = 1.7)	2.29 (s, Me)	6.98 (d, J_m = 1.5)	5.8 (br.s)	11.5 (br.s)	4.41 (br.s, CH_2); 7.13—7.32 (m, Ph); 6.09 (tt, CF_2CF_2H, ^2J = 53.2, ^3J = 5.3)	3200, 1620, 1585, 1550
2i[j]	5.55 (s, 0.8 H)	6.82 (d, J_o = 8.3)	7.12 (dd, J_o = 8.3, J_m = 1.6)	2.28 (s, Me)	6.97 (d, J_m = 1.4)	—	11.5 (br.s, 0.2 H)	4.43 (br.s, CH_2); 7.17—7.34 (m, Ph); 6.12 (tt, CF_2CF_2H, ^2J = 53.2, ^3J = 5.4)	—

[a] In $CDCl_3$
[b] Alcoholic hydroxy group.
[c] Phenolic hydroxy group.
[d] The signal appears as a triplet of doublets (J_o = 7.5 Hz).
[e] In DMSO-d_6.
[f] The spectrum was recorded on a Bruker DPX-200 spectrometer (200.1 MHz).
[g] The signal overlaps with the protons of the Ph group.
[h] From the ^{19}F NMR spectrum with reference to $CFCl_3$.
[i] Poorly soluble in $CDCl_3$.
[j] In $CDCl_3$—CD_3CO_2D.

The conversion of amino enones **2** into chromeniminium cations **3** can be observed in an NMR tube. For instance, the addition of CF_3CO_2H (but not CD_3CO_2D) to a solution of amino enone **2d** in $CDCl_3$ immediately results in the formation of chromeniminium trifluoroacetate **3d**; the signals for all protons in this compound are significantly shifted downfield compared to the nonprotonated form (Table 2). In the case of chromenimines **4**, which are stronger bases than amino enones **2**, the formation of cation **3** is deduced from a similar pattern observed upon addition of either CF_3CO_2H or CD_3CO_2D. The ^{1}H NMR spectra of chromenimines **4** show one set of signals and correlate well with their structures[4,8] in which the R group is remote from the H(5) atom (see Table 2).

Thus, we described a simple and convenient route to 3-alkylamino-3-(2-hydroxyaryl)-1-polyfluoroalkylprop-2-en-1-ones **2** and 2-polyfluoroalkyl-4*H*-chromen-4-

Scheme 4



R^F = CF_3 (**a**, **c**), $(CF_2)_2H$ (**f**)
R = CH_2Ph (**a**, **f**), $(CH_2)_2OH$ (**c**)

imines **4**, which are of interest for the regioselective synthesis of heterocyclic systems containing R^F groups. In acidic media, 2-R^F-chromen-4-imines are more reactive than 2-R^F-chromones, which substantially broadens the synthetic potential of the chromone system as a whole.

Experimental

IR spectra were recorded on an IKS-29 instrument (Nujol). ^{1}H NMR spectra were recorded on a Bruker DRX-400 spectrometer (400.1 MHz) in $CDCl_3$ or DMSO-d_6 with Me_4Si as the internal standard. ^{1}H NMR and IR spectroscopic data are given in Tables 1 (for imines **1a**—**e** and amino enones **2a**—**i**) and 2 (for chromenimines **4a**—**i** and salts **3d**,**e** and **6a**,**b**,**d**). The physicochemical characteristics of the compounds obtained are given in Table 3.

2-(1-Benzyliminoethyl)phenol (1a) was prepared according to a known procedure[21] in 82% yield; yellow needle-like crystals, m.p. 119—120 °C (Ref.[22]: m.p. 118—119 °C).

Table 2. ^{1}H NMR and IR spectra of chromenimines **4a**—**i** and salts **3d**,**e** and **6a**,**b**,**d**

Compound	^{1}H NMR ($CDCl_3$), δ, *J*/Hz							IR, ν/cm^{-1}
	H(3)	H(5)	H(6)	H(7)	H(8)	R	$H(CF_2)_2$	
4a	6.83 (s)	8.34 (d, J_o = 7.7)	—[a]	7.52 (ddd, J_o = 8.4, J_o = 7.3, J_m = 1.6)	—[a]	4.76 (s, CH_2); 7.27—7.44 (m, Ph)	—	1670, 1600, 1580
4b	6.73 (s)	8.25 (dd, J_o = 8.0, J_m = 1.6)	7.28 (ddd, J_o = 8.0, J_o = 7.3, J_m = 1.0)	7.47 (ddd, J_o = 8.3, J_o = 7.3, J_m = 1.7)	7.25 (dd, J_o = 8.3, J_m = 1.0)	1.24 (d, 2 Me, J = 6.2); 3.87 (septet, CH, J = 6.2)	—	1675, 1620, 1610, 1585
4c	6.71 (s)	8.22 (dd, J_o = 8.0, J_m = 1.6)	7.31 (ddd, J_o = 8.0, J_o = 7.3, J_m = 1.1)	7.52 (ddd, J_o = 8.4, J_o = 7.3, J_m = 1.7)	7.29 (dd, J_o = 8.4, J_m = 0.8)	3.60 (t, CH_2N, J = 5.2); 3.96 (t, CH_2O, J = 5.2); 2.8 (br.s, OH)	—	3215, 3110, 3080, 1670, 1620, 1575
4d	6.81 (s)	8.12 (s)	2.40 (s, Me)	—[a]	7.20 (d, J_o = 8.5)	4.76 (s, CH_2); 7.26—7.42 (m, Ph)	—	1670, 1620, 1610, 1575, 1495
4d[b]	6.90 (s)	8.31 (s)	2.45 (s, Me)	7.47 (dd, J_o = 8.6, J_m = 1.7)	7.33 (d, J_o = 8.6)	4.87 (s, CH_2); 7.25—7.41 (m, Ph)	—	—
4e	6.70 (s)	8.02 (d, J_m = 1.2)	2.42 (s, Me)	7.33 (dd, J_o = 8.4, J_m = 2.0)	7.20 (d, J_o = 8.4)	3.60 (t, CH_2N, J = 5.3); 3.96 (t, CH_2O, J = 5.3); 2.6 (br.s, OH)	—	3240, 1675, 1610, 1580
4e[c]	7.41 (s)	8.33 (s)	2.55 (s, Me)	7.87 (d, J_o = 8.7)	7.70 (d, J_o = 8.7)	4.03 (t, CH_2N, J = 4.7); 4.14 (t, CH_2O, J = 4.7)	—	—
4f	6.83 (s)	8.35 (dd, J_o = 8.0, J_m = 1.6)	7.32 (ddd, J_o = 8.0, J_o = 7.3, J_m = 1.1)	7.50 (ddd, J_o = 8.4, J_o = 7.3, J_m = 1.7)	—[a]	4.76 (s, CH_2); 7.26—7.45 (m, Ph)	6.12 (tt, ^2J = 53.1, ^3J = 4.3)	1660, 1620, 1605, 1580, 1500
4g	6.74 (s)	8.25 (d, J_o = 7.7)	7.27 (t, J_o = 8.1)	7.47 (ddd, J_o = 8.3, J_o = 7.3, J_m = 1.6)	7.22 (d, J_o = 8.3)	1.25 (d, 2 Me, J = 6.3); 3.90 (septet, CH, J = 6.3)	6.12 (tt, ^2J = 53.1, ^3J = 4.3)	1670, 1610, 1580

(*to be continued*)

Table 2 (*continued*)

Compound	^{1}H NMR ($CDCl_3$), δ, *J*/Hz							IR, ν/cm^{-1}
	H(3)	H(5)	H(6)	H(7)	H(8)	R	$H(CF_2)_2$	
4g[b]	7.03 (s)	8.80 (d, J_o = 8.1)	7.59 (t, J_o = 7.6)	7.82 (t, J_o = 7.7)	7.56 (d, J_o = 8.5)	1.46 (d, 2 Me, *J* = 6.4); 4.21 (septet, CH, *J* = 6.4)	6.24 (tt, ^2J = 52.7, ^3J = 3.6)	—
4h[d]	6.71 (s)	8.24 (d, J_o = 7.8)	7.31 (t, J_o = 7.5)	7.50 (t, J_o = 7.7)	7.27 (d, J_o = 8.3)	3.60 (t, CH_2N, *J* = 5.1); 3.94 (t, CH_2O, *J* = 5.1); 2.5 (br.s, OH)	6.10 (tt, ^2J = 53.1, ^3J = 4.0)	3205, 1665, 1620, 1605, 1580
4h[b,d]	7.39 (s)	8.71 (d, J_o = 7.8)	7.67 (t, J_o = 7.5)	7.91 (t, J_o = 7.7)	7.64 (d, J_o = 8.3)	4.03 (s, CH_2N); 4.06 (s, CH_2O)	6.24 (tt, ^2J = 52.7, ^3J = 3.2)	—
4i	6.81 (s)	8.13 (d, J_m = 1.1)	2.40 (s, Me)	7.31 (dd, J_o = 8.5, J_m = 1.8)	7.16 (d, J_o = 8.5)	4.76 (s, CH_2); 7.25—7.44 (m, Ph)	6.12 (tt, ^2J = 53.1, ^3J = 4.3)	1665, 1600, 1585, 1490
3d[e]	7.19 (s)	8.38 (s)	2.55 (s, Me)	7.88 (dd, J_o = 8.7, J_m = 1.7)	7.70 (d, J_o = 8.7)	5.01 (s, CH_2); 7.35—7.44 (m, Ph)	—	—
3e[f]	7.94 (s)	8.94 (s)	2.52 (s, Me)	7.96 (dd, J_o = 8.7, J_m = 1.6)	7.90 (d, J_o = 8.7)	3.79 (t, CH_2N, *J* = 5.1); 4.02 (br.s, CH_2O); 4.2 (br.s, OH+H_2O)	12.6 (br.s, H—N^+=)	3360, 3100, 1665, 1625, 1585
6a	7.19 (s)	9.00 (d, J_o = 8.2)	7.82 (t, J_o = 7.4)	8.03 (t, J_o = 7.5)	7.72 (dd, J_o = 8.6, J_m = 0.9)	5.03 (s, CH_2); 7.32—7.47 (m, Ph)	—	2055, 1665, 1620, 1515
6b	7.14 (s)	9.20 (d, J_o = 8.1)	7.83 (t, J_o = 7.5)	8.01 (t, J_o = 7.8)	7.72 (dd, J_o = 8.5, J_m = 0.8)	1.66 (d, 2 Me, *J* = 6.5); 4.31 (septet, CH, *J* = 6.5)	—	2060, 1665, 1620
6d	7.12 (s)	8.70 (s)	2.67 (s, Me)	7.83 (dd, J_o = 8.7, J_m = 1.6)	7.62 (d, J_o = 8.7)	4.98 (s, CH_2); 7.32—7.46 (m, Ph)	—	2055, 1660, 1610

[a] The signal overlaps with the protons of the Ph group.
[b] The spectrum of compound **4** in $CDCl_3$—CD_3CO_2D.
[c] The spectrum of compound **4e** in $CDCl_3$—CF_3CO_2H.
[d] The spectrum was recorded on a Bruker WM-250 spectrometer (250.1 MHz).
[e] The spectrum of compound **2d** in $CDCl_3$—CF_3CO_2H.
[f] In DMSO-d_6.

2-(1-Isopropyliminoethyl)phenol (1b) was synthesized by a modified method.[23] Anhydrous Et_2O (175 mL), isopropylamine (29.6 mL, 20.5 g, 0.35 mol), and 2-hydroxyacetophenone (14.0 mL, 15.8 g, 0.12 mol) were placed in a round-bottom three-neck flask equipped with a mechanical stirrer, a reflux condenser, and a dropping funnel. A solution of $TiCl_4$ (6.4 mL, 11.0 g, 0.058 mol) in 60 mL of hexane was added dropwise to the stirred solution over 40 min, while maintaining the reaction temperature at ≈0 °C (ice bath). Then, the reaction mixture was refluxed for 3 h and cooled. The precipitate that formed was filtered off and washed with 50 mL of Et_2O. The filtrate was distilled and a fraction with b.p. 127—130 °C (5 Torr) was collected; yellow liquid. The yield of **1b** was 12.0 g (58%). Imine **1b** was described earlier[22] without specifying the synthetic procedure or reporting its boiling point.

2-[1-(2-Hydroxyethylimino)ethyl]phenol (1c). Toluene (30 mL), 2-hydroxyacetophenone (10.0 mL, 11.3 g, 0.083 mol), 2-aminoethanol (5.0 mL, 5.1 g, 0.083 mol), and 2 drops of conc. HCl were placed in a round-bottom flask fitted with a Dean—Stark trap and a reflux condenser. The reaction mixture was refluxed for 1 h until the water was completely removed and left overnight at ≈20 °C. The crystalline product was filtered off, washed with toluene, and dried. The yield of **1c** was 13.6 g (91%), m.p. 99—100 °C, large yellow crystals. Found (%): C, 66.93; H, 7.36; N, 7.84. $C_{10}H_{13}NO_2$. Calculated (%): C, 67.02; H, 7.31; N, 7.82.

2-(1-Benzyliminoethyl)-4-methylphenol (1d) was prepared according to a known procedure[21] in 70% yield; yellow needle-like crystals, m.p. 103—104 °C. Found (%): C, 80.41; H, 7.25; N, 5.91. $C_{16}H_{17}NO$. Calculated (%): C, 80.30; H, 7.16; N, 5.85.

2-[1-(2-Hydroxyethylimino)ethyl]-4-methylphenol (1e) was synthesized as described for imine **1c**. The yield of **1e** was 94%; large yellow crystals, m.p. 135—136 °C. Found (%): C, 68.39; H, 7.90; N, 7.21. $C_{11}H_{15}NO_2$. Calculated (%): C, 68.37; H, 7.82; N, 7.25.

5-[1-(2-Hydroxyethylimino)ethyl]-4,7-dimethoxybenzofuran-6-ol (9) was obtained as described for imines **1c**,**e**. The yield of **9** was 86%; yellow crystals, m.p. 121—122 °C (toluene). Found (%): C, 60.17; H, 6.18; N, 4.93. $C_{14}H_{17}NO_5$. Calculated (%): C, 60.21; H, 6.14; N, 5.02. IR, ν/cm^{-1}: 3300 (OH),

Table 3. Physicochemical properties and elemental analysis data for amino enones **2a—i**, chromenimines **4a—i**, and salts **3e** and **6a**,**b**,**d**

Compound	Yield (%)	M.p./°C (solvent)	Molecular formula	Found / Calculated (%)		
				C	H	N
2a	82	154—155 (CCl_4—MePh, 2 : 1)	$C_{17}H_{14}F_3NO_2$	63.48 / 63.55	4.32 / 4.39	4.28 / 4.36
2b	65	155—156 (CCl_4)	$C_{13}H_{14}F_3NO_2$	57.16 / 57.14	5.24 / 5.16	5.00 / 5.13
2c	61	166—167 (MePh—BuOH, 3 : 1)	$C_{12}H_{12}F_3NO_3$	52.36 / 52.37	4.53 / 4.39	5.10 / 5.09
2d	70	145—146 (C_6H_{14}—CCl_4)	$C_{18}H_{16}F_3NO_2$	64.51 / 64.47	4.86 / 4.81	3.91 / 4.18
2e	51	180—181 [a]	$C_{13}H_{14}F_3NO_3$	54.07 / 53.98	4.93 / 4.88	4.72 / 4.84
2f	38	135—136 [b] (CCl_4)	$C_{18}H_{15}F_4NO_2$	61.34 / 61.19	4.50 / 4.28	4.16 / 3.96
2g	11	152—153 (CCl_4)	$C_{14}H_{15}F_4NO_2$	55.30 / 55.08	5.08 / 4.95	4.87 / 4.59
2h	33	117—118 ($CHCl_3$)	$C_{13}H_{13}F_4NO_3$	51.06 / 50.82	4.21 / 4.26	4.33 / 4.56
2i	27	135—136 (C_6H_{14})	$C_{19}H_{17}F_4NO_2$	62.04 / 62.12	4.42 / 4.66	3.72 / 3.81
4a	85	111—112 (C_6H_{14})	$C_{17}H_{12}F_3NO$	67.23 / 67.33	4.01 / 3.99	4.51 / 4.62
4b	72	61—62 (C_6H_{14})	$C_{13}H_{12}F_3NO$	61.22 / 61.18	4.77 / 4.74	5.37 / 5.49
4c	64	103—104 (C_6H_{14}—MePh, 1 : 1)	$C_{12}H_{10}F_3NO_2$	56.08 / 56.04	3.89 / 3.92	5.45 / 5.45
4d	77	98—99 (C_6H_{14})	$C_{18}H_{14}F_3NO$	68.04 / 68.13	4.54 / 4.45	4.12 / 4.41
4e	67	137—138 (C_6H_{14})	$C_{13}H_{12}F_3NO_2$	57.65 / 57.57	4.59 / 4.46	5.00 / 5.16
4f	93	88—89 (C_6H_{14})	$C_{18}H_{13}F_4NO$	64.34 / 64.48	4.00 / 3.91	4.07 / 4.18
4g	63	67—68 (C_6H_{14})	$C_{14}H_{13}F_4NO$	58.31 / 58.54	4.79 / 4.56	4.77 / 4.88
4h	85	115—116 [c] (C_6H_{14})	$C_{13}H_{11}F_4NO_2$	54.00 / 53.99	3.69 / 3.83	4.88 / 4.84
4i	91	95—96 (C_6H_{14})	$C_{19}H_{15}F_4NO$	65.20 / 65.33	4.43 / 4.33	3.85 / 4.01
3e	66	subl.	$C_{13}H_{13}ClF_3NO_2 \cdot H_2O$	48.25 / 47.94	4.45 / 4.64	4.16 / 4.30
6a	83	157—158 (MePh)	$C_{18}H_{13}F_3N_2OS$	59.75 / 59.66	3.74 / 3.62	7.87 / 7.73
6b	69	subl.	$C_{14}H_{13}F_3N_2OS$	53.34 / 53.50	4.15 / 4.17	8.98 / 8.91
6d	76	173—174 (MePh)	$C_{19}H_{15}F_3N_2OS$	60.80 / 60.63	3.93 / 4.02	7.56 / 7.44

[a] Precipitated with chloroform from its solution in isopropyl alcohol.
[b] Prior to recrystallization, the crude product was passed through a layer of silica gel (d = 25 mm, l = 60 mm) and eluted with $CHCl_3$ (70 mL).
[c] Ref.[8]: 114—115 °C.

1615, 1575 (C=N, arom.). ^{1}H NMR ($CDCl_3$), δ: 2.53 (s, 3 H, Me); 3.73 (t, 2 H, CH_2N, J = 5.2 Hz); 3.95 (s, 3 H, MeO); 4.02 (t, 2 H, CH_2O, J = 5.2 Hz); 4.03 (s, 3 H, MeO); 6.77 (d, 1 H, H(3), J = 2.3 Hz); 7.42 (d, 1 H, H(2), J = 2.3 Hz). (Non-recrystallized imine **9** contains 17% khellinone (^{1}H NMR data). ^{1}H NMR ($CDCl_3$), δ: 2.73 (s, 3 H, Me); 4.04 (s, 3 H, MeO); 4.14 (s, 3 H, MeO); 6.90 (d, 1 H, H(3), J = 2.3 Hz); 7.51 (d, 1 H, H(2), J = 2.3 Hz)).

Synthesis of 3-alkylamino-3-(2-hydroxyaryl)-1-polyfluoroalkylprop-2-en-1-ones 2a—i and 10 (general procedure). Anhydrous THF (20 mL), finely ground LiH (0.50 g, 0.063 mol), CF_3CO_2Et (3.2 mL, 3.8 g, 0.027 mol), and the corresponding imine (0.018 mol) were placed in a round-bottom three-neck flask fitted with a mechanical stirrer and a reflux condenser. The stirred reaction mixture was refluxed for 4 h, whereupon the solvent was removed *in vacuo*. The residue was treated with 7% AcOH and the product (white powder) was filtered off, washed with water, dried, and recrystallized from an appropriate solvent (see Table 3).

Synthesis of 2-polyfluoroalkyl-4*H*-chromen-4-imines 4a—i (general procedure). Amino enone **2** (0.0125 mol) was dissolved in 16 mL of ethanol saturated with HCl. The mixture was left at ≈20 °C for 2 h and then mixed with cold water (150 mL). Then, aqueous 25% NH_3 (16 mL) was added in one portion to the stirred solution. The precipitate of chromenimine **4** that formed was filtered off, washed with water, dried, and recrystallized from hexane (the hot solution was filtered to remove an impurity of amino enone **2**, which is insoluble in nonpolar solvents) (see Table 3). Chromenimines **4** are storage-stable colorless needle-like crystals.

***N*-(2-Hydroxyethyl)-6-methyl-2-trifluoromethyl-4*H*-chromen-4-imine hydrochloride (3e).** Amino enone **2e** (0.30 g, 1.0 mmol) was dissolved in 1.5 mL of ethanol saturated with HCl. The resulting solution was kept at ≈0 °C for 2 h and mixed with EtOH (2 mL) and Et_2O (7 mL). The precipitate that formed was filtered off, washed with Et_2O, and dried (see Table 3).

Hydrolysis of amino enones 2a,b,d and chromenimines 4a,b,d. Amino enone **2** or chromenimine **4** (0.65 mmol) was heated with 65% AcOH (2 mL) at 80 °C for 1 h. The reaction mixture was allowed to cool and diluted with 10 mL of water. The colorless precipitate of chromanone **5** that formed was filtered off, washed with H_2O, and dried.

2-Hydroxy-2-trifluoromethylchroman-4-one (5a) was obtained upon hydrolysis of amino enones **2a**,**b** and chromenimines **4a**,**b** in 70—72 and 60—65% yields, respectively; colorless crystals, m.p. 153—154 °C (Ref. 24: m.p. 151—153 °C). ^{1}H NMR ($CDCl_3$), δ: 3.04 (d, 1 H, C<u>H</u>H, J_{AB} = 16.7 Hz); 3.10 (d, 1 H, CH<u>H</u>, J_{AB} = 16.7 Hz); 3.61 (s, 1 H, OH); 7.07 (dd, 1 H, H(8), J_o = 8.3 Hz, J_m = 1.0 Hz); 7.15 (ddd, 1 H, H(6), J_o = 7.8 and 7.3 Hz, J_m = 1.0 Hz); 7.58 (ddd, 1 H, H(7), J_o = 8.3 and 7.3 Hz, J_m = 1.7 Hz); 7.93 (dd, 1 H, H(5), J_o = 7.8 Hz, J_m = 1.7 Hz).

2-Hydroxy-6-methyl-2-trifluoromethylchroman-4-one (5d) was obtained upon hydrolysis of amino enone **2d** and chromenimine **4d** in 60 and 62% yields, respectively; colorless needles, m.p. 158—159 °C (Ref. 25: m.p. 157 °C). ^{1}H NMR ($CDCl_3$), δ: 2.33 (s, 3 H, Me); 3.00 (d, 1 H, C<u>H</u>H, J_{AB} = 16.7 Hz); 3.07 (d, 1 H, CH<u>H</u>, J_{AB} = 16.7 Hz); 3.60 (s, 1 H, OH); 6.96 (d, 1 H, H(8), J_o = 8.4 Hz); 7.38 (dd, 1 H, H(7), J_o = 8.4 Hz, J_m = 2.2 Hz); 7.71 (d, 1 H, H(5), J_m = 2.2 Hz).

Synthesis of amino enones 2a,d from chromenimines 4a,d (general procedure). Chromenimine **4** (0.65 mmol) was added to 2 mL of an ammonium acetate solution prepared by mixing glacial AcOH (8 mL), water (2 mL), and 25% NH_3 (3 mL). The reaction mixture was thoroughly stirred for 30 min and then diluted with 5 mL of water. The colorless precipitate of amino enone **2** that formed was filtered off, washed with H_2O, and dried. The yields of amino enones **2a**,**d** were 90 and 97%, respectively.

Synthesis of thiocyanates 6a,b,d (general procedure). Potassium thiocyanate (0.40 g, 4.1 mmol) and chromenimines **4a**,**d** (0.66 mmol) were triturated in 2 mL of AcOH—water (2 : 1) for 5 min (for **4b**, in 2.5 mL of Me_2CO—AcOH—water (2 : 2 : 1)). The reaction mixture was diluted with 10 mL of water and the precipitate that formed was filtered off, dried, and recrystallized from toluene (see Table 3). Acid hydrolysis of thiocyanates **6a**,**b**,**d** under the conditions described for compounds **2a**,**b**,**d** and **4a**,**b**,**d** gave chromanones **5a**,**d** in 71 and 65% yields, respectively.

5-[4,4,4-Trifluoro-3-(2-hydroxyethylamino)-1-oxobut-2-enyl]-6-hydroxy-4,7-dimethoxybenzofuran (8a). Trifluorokhellin **7a** (0.19 g, 0.60 mmol) and 2-aminoethanol (0.06 g, 1.0 mmol) were dissolved in 1.5 mL of ethanol, stirred at ≈20 °C for 24 h, and then diluted with 10 mL of water. The precipitate that formed within 4 h was filtered off, washed with water, dried, and recrystallized from toluene—hexane (1 : 1). The yield of **8a** was 0.06 g (26%); orange crystals, m.p. 134 °C. Found (%): C, 51.32; H, 4.50; N, 3.52. $C_{16}H_{16}F_3NO_6$. Calculated (%): C, 51.21; H, 4.30; N, 3.73. IR, ν/cm^{-1}: 3480 (OH), 3170 (CH=), 1640 (NH), 1620 (C=O), 1550 (C=C). ^{1}H NMR ($CDCl_3$), δ: **amino enone form** (50%): 3.6—3.7 (m, 3 H, CH_2N, OH); 3.90 (t, 2 H, CH_2O, J = 5.3 Hz); 3.98 (s, 3 H, MeO); 4.07 (s, 3 H, MeO); 6.84 (s, 1 H, CH=); 6.83 (d, 1 H, H(3), J = 2.1 Hz); 7.49 (d, 1 H, H(2), J = 2.1 Hz); 10.6 (br.s, 1 H, NH); 12.9 (br.s, 1 H, phenolic OH); **oxazolidine form** (50%): 3.06 (d, 1 H, C<u>H</u>H, J_{AX} = 14.7 Hz); 3.1—3.4 (m, 2 H, CH_2N); 3.6—4.0 (m, 2 H, CH_2O); 4.05 (s, 3 H, MeO); 4.18 (s, 3 H, MeO); 4.40 (d, 1 H, C<u>H</u>H, J_{AX} = 14.7 Hz); 6.91 (d, 1 H, H(3), J = 2.4 Hz); 7.52 (d, 1 H, H(2), J = 2.4 Hz); 12.4 (br.s, 1 H, OH). ^{1}H NMR (DMSO-d_6), δ: 3.47 (q, 2 H, CH_2N, J = 5.3 Hz); 3.63 (q, 2 H, CH_2O, J = 5.1 Hz); 3.89 (s, 3 H, MeO); 3.95 (s, 3 H, MeO); 5.10 (t, 1 H, OH, J = 4.9 Hz); 6.21 (s, 1 H, CH=); 7.10 (d, 1 H, H(3), J = 2.4 Hz); 7.87 (d, 1 H, H(2), J = 2.4 Hz); 10.4 (br.s, 1 H, NH); 11.2 (s, 1 H, phenolic OH).

6-Hydroxy-5-[3-(2-hydroxyethylamino)-1-oxobut-2-enyl]-4,7-dimethoxybenzofuran (8b). Khellin **7b** (0.25 g, 0.96 mmol) was thoroughly triturated with 2-aminoethanol (0.12 g, 2.0 mmol). The resulting mixture was left for six days and then mixed with water (10 mL). The precipitate that formed was filtered off, washed with water, dried, and recrystallized from toluene. The yield of **8b** was 0.28 g (90%); yellow crystals, m.p. 146 °C. Found (%): C, 59.84; H, 6.14; N, 4.21. $C_{16}H_{19}NO_6$. Calculated (%): C, 59.81; H, 5.96; N, 4.36. IR, ν/cm^{-1}: 3480 (OH), 1635 (NH), 1590, 1570, 1545, 1510 (C=O, C=C, arom.). ^{1}H NMR ($CDCl_3$), δ: 2.11 (s, 3 H, Me); 2.33 (br.s, 1 H, OH); 3.52 (q, 2 H, CH_2N, J = 5.6 Hz); 3.85 (br.s, 2 H, CH_2O); 3.91 (s, 3 H, MeO); 4.06 (s, 3 H, MeO); 6.20 (d, 1 H, CH=); 6.78 (d, 1 H, H(3), J = 2.1 Hz); 7.44 (d, 1 H, H(2), J = 2.1 Hz); 11.2 (br.s, 1 H, NH); 13.5 (br.s, 1 H, phenolic OH).

5-[4,4,4-Trifluoro-1-(2-hydroxyethylamino)-3-oxobut-1-enyl]-6-hydroxy-4,7-dimethoxybenzofuran (10) was obtained as described for amino enones **2**. The yield of **10** was 58%; colorless crystals, m.p. 169—170 °C (toluene). Found (%): C, 51.43; H, 4.31; N, 3.74. $C_{16}H_{16}F_3NO_6$. Calculated (%): C, 51.21;

H, 4.30; N, 3.73. IR, ν/cm^{-1}: 3230 (OH), 1615 (C=O), 1575, 1495 (C=C, arom.). ^{1}H NMR (DMSO-d_6), δ: 3.19 (m, 2 H, CH_2N); 3.48 (m, 2 H, CH_2O); 3.92 (s, 3 H, MeO); 3.98 (s, 3 H, MeO); 5.0 (br.s, 1 H, OH); 5.26 (s, 1 H, CH=); 7.19 (d, 1 H, H(3), J = 2.3 Hz); 7.92 (d, 1 H, H(2), J = 2.3 Hz); 9.6 (br.s, 1 H, phenolic OH); 11.45 (t, 1 H, NH, J = 5.8 Hz).

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