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# Cyclocondensation of α-Aminonitriles and Enones: A Short Access to 3,4-Dihydro-2*H*-pyrrole 2-carbonitriles and 2,3,5-Trisubstituted Pyrroles

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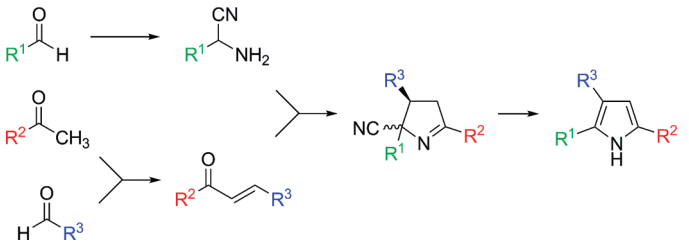

The reaction of α,β-unsaturated carbonyl compounds with aminoacetonitrile hydrochloride furnishes 3,5-disubstituted 3,4-dihydro-2*H*-pyrrole-2-carbonitriles in a one-pot reaction sequence. While these products can serve as starting materials for the preparation of polysubstituted pyrrolizidines, they are kinetically stable against the base-induced elimination of HCN. In contrast, their 2-substituted analogues obtained from α-substituted α-aminonitriles can be readily converted to the corresponding 2,3,5-trisubstituted pyrroles under microwave irradiation. The key step presumably involves the thermal electrocyclization of a stabilized 2-azapentadienyl anion formed by condensation of the reactants and subsequent deprotonation.

## Introduction

The cyclization of open-chain compounds represents a straightforward access to carbo- and heterocyclic compounds. In contrast to the frequently employed amide bond formations, intramolecular aldol condensations, or transition-metal-catalyzed carbon−carbon bond formations, electrocyclizations involve not only the termini of the seco precursor but also its entire conjugated π-electron system. While the stereochemistry of electrocyclic ring closure and its reversion is governed by orbital symmetry,[1] the thermodynamics of the reaction may depend on, e.g., steric factors, ring strain, or charge stabilization in the product. As demonstrated by Hunter and Steiner[2,3] as well as by Würthwein et al.,[4−7] the relative energy of the seco and cyclo forms of azapentadienyl anions is determined by the position of the nitrogen atom in the chain. For the nitrogen-free system as well as for its 1- and 3-aza analogues, the seco form is lower in energy while for the 2-azapentadienyl anion, cyclization is energetically favored. This may be attributed to the electronic perturbation exerted by the more electronegative nitrogen atom which, if located at a nodal plane of the HOMO in the seco form, promotes ring closure to maximize its HOMO coefficient.

The anion-stabilizing capacity of the cyano group permits the deprotonation of α-aminonitriles even in the presence of potentially acidic NH protons. The resulting aminoketeniminate salts can serve as readily available α-aminocarbanion equivalents for the preparation of a variety of amines and N-heterocycles.[8−11]

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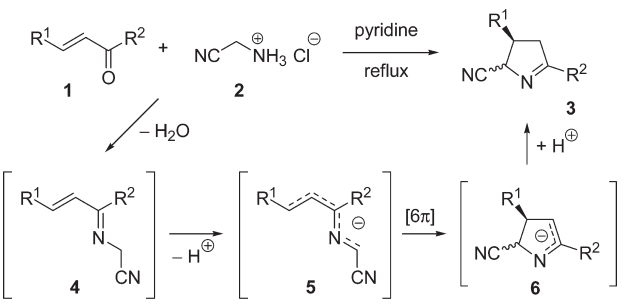
Extension of the conjugated system by introduction of a C=N double bond through formation of an imine further increases the CH-acidity. Thus, α-(alkylidenenamino)nitriles can even be deprotonated with amine or amidine bases to furnish stabilized 2-azaallyl anions, which are known to undergo exceptionally clean 1,4-additions to a variety of Michael acceptors while 1,3-dipolar cycloadditions of their N-protonated or N-metalated counterparts have been reported as well.[12−15] If Strecker products derived from ammonia are condensed with α,β-unsaturated ketones, the resulting Schiff bases furnish stabilized 2-azapentadienyl anions upon deprotonation. In analogy to the unsubstituted parent system, these Hückel aromatic anions may in turn undergo a disrotatory thermal electrocyclization to furnish the anions of pyrroline-2-carbonitriles.[12,16] Herein, we report on the development of this reaction as well as on its application to the synthesis of cyanopyrrolines and pyrroles.

## Results and Discussion

Aminoacetonitrile is unstable in pure form, but its hydrochloride and sulfate salts can be stored indefinitely at ambient temperature and are commercially available. When aminoacetonitrile hydrochloride was heated with chalcone in the presence of bases, a compound possessing diastereotopic methylene protons was detected in the NMR spectra of the reaction mixtures. To improve the conversion, several solvents were tested. The reaction was carried out in DMF, DMSO, diglyme, glyme, xylene, and acetic acid in the presence of DIPEA (2 equiv) as well as in neat DIPEA and pyridine. TLC indicated that all other solvents except for DIPEA led to the expected product with pyridine exhibiting the least formation of byproducts. Variation of the temperature showed refluxing pyridine to be the best solvent for the reaction. However, thermal decomposition of the aminonitrile is an issue, and higher yields can be obtained if superstoichiometric amounts (1.5−2 equiv) of the hydrochloride are employed. Lower reaction temperatures did not lead to a significant improvement, and below 80 °C, the reaction ceased. Microwave heating led to diminished yields due to extensive decomposition of aminoacetonitrile hydrochloride which could be attributable to an efficient conversion of microwave energy into heat by the polar salt.[17] Variation of the amount of solvent and addition of catalytic amount of acids or bases had no noticeable effect on the rate of conversion. The product could be identified as 3,5-diphenyl-3,4-dihydro-2*H*-pyrrole-2-carbonitrile **3a**. Presumably, the reaction takes the course depicted in Scheme 1.

Condensation of the components furnishes imine **4**, which is deprotonated to 2-azapentadienyl anion **5**. Electrocyclization furnishes the 1-azaallyl anion **6**, which is reprotonated to the thermodynamically more stable 3,4-dihydro-2*H*-pyrrole **3**. However, a stepwise mechanism involving two molecules of enone cannot be ultimately ruled out. Due to the high acidity of the proton in the 2-position, compounds **3** are invariably obtained as thermodynamic mixtures of cis- and trans-isomers (isomeric ratio trans/cis 1.2−3.3:1). The isomers can be separated chromatographically, and reequilibration occurs under basic conditions. A similar reaction has been described by Koch et al. for the formation of 3,5-diphenyl-3,4-dihydro-2*H*-pyrrole-2,2-dicarboxylic acid diethyl ester from diethyl aminomalonate and chalcone, although no mechanistic rationale for the ring closure was given.[18,19] Compounds of type **3** have been prepared by Tasheva et al. by vinylogous addition of (diphenylmethyleneamino)acetonitrile to enones and acidolysis of the products.[20] However, the presented protocol compares favorably with the latter reaction sequence in terms of simplicity and atom economy. To evaluate the substrate scope of our one-pot procedure, various acyclic α,β-unsaturated carbonyl compounds were subjected to the optimized reaction conditions. The results are summarized in Table 1.

**SCHEME 1. Proposed Reaction Mechanism**




While yields up to 90% could be achieved with chalcone derivatives, neither cinnamaldehyde nor ethyl vinyl ketone gave the reaction. Benzylideneacteone reacted in a yield of 49% which is reduced by increased steric bulk in the alkyl portion. The isopropyl group is still tolerated while the tert butyl substituent is not. The structures of the trans-isomers of compounds **3f** and **3g** have been determined by X-ray crystallography (see the Supporting Information). The high mobility of H-2 in compounds **3** prevents the elimination of HCN by treatment with strong bases and hampers their direct conversion to 2,4-disubstituted pyrroles. Attempts to react the salts of **3** with dienophiles in a 1,3-dipolar cycloaddition to furnish 7-azabicyclo[2.2.1]heptanes have so far met with little success,[21−24] whereas their oxidation to pyrrole-2-carbonitriles proceeds in high yield. The vinylogous addition of compounds **3** to enones can serve as the key step for a short synthesis of 1,3,5-trisubstituted pyrrolizidines (Scheme 2).

Exhaustive reduction of the addition product **8** with an excess of sodium cyanoborohydride furnished pyrrolizidine

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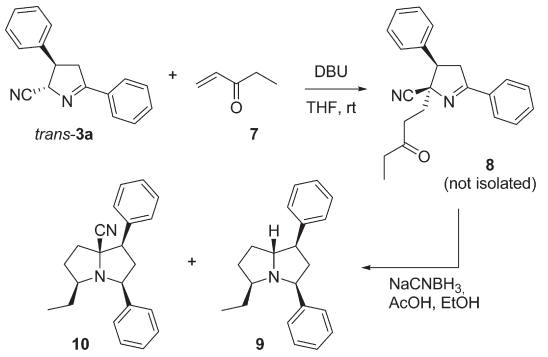
**TABLE 1. Results of the Cyclization**

| entry | product | $R^1$ | $R^2$ | reaction time (h) | yield (%) | *trans*/*cis*[a] |
|---|---|---|---|---|---|---|
| 1 | **3a** | Ph | Ph | 8 | 64 | 3.0:1 |
| 2 | **3b** | 4-MeO-$C_6H_4$ | 4-F-$C_6H_4$ | 40 | 53 | 2.9:1 |
| 3 | **3c** | 4-CN-$C_6H_4$ | Ph | 17 | 53 | 2.4:1 |
| 4 | **3d** | 3-$NO_2$-$C_6H_4$ | 4-Cl-$C_6H_4$ | 5 | 90 | 2.6:1 |
| 5 | **3e** | Ph | 2-Naphth | 8 | 90 | 3.3:1 |
| 6 | **3f** | 2-Br-$C_6H_4$ | 2-Naphth | 6 | 77 | 2.7:1 |
| 7 | **3g** | Ph | benzo[*b*]furan-2-yl | 6 | 64 | 3.3:1 |
| 8 | **3h** | 4-Cl-$C_6H_4$ | (*E*)-4-chlorostyryl | 4 | 38 | 2.8:1 |
| 9 | **3i** | 2-Cl-$C_6H_4$ | 4-F-$C_6H_4$ | 3.5 | 77 | 1.3:1 |
| 10 | **3j** | Ph | Me | 4 | 49 | 3.3:1 |
| 11 | **3k** | 4-Cl-$C_6H_4$ | $^i$Pr | 18 | 33[c] | 1.2:1 |
| 12 | **3l** | 4-Cl-$C_6H_4$ | $^t$Bu | | [b] | |
| 13 | **3m** | Ph | H | | [b] | |
| 14 | **3n** | H | Et | | [b] | |

[a]Determined by $^1$H NMR spectroscopy. [b]No conversion. [c]Contains impurities.

**SCHEME 2. Preparation of Pyrrolizidines**




**9** in 62% yield and more than 85% diastereoselectivity but required elevated temperatures. The course of the reaction presumably involves imine reduction, reductive cyclization, and subsequent decyanation.[14] If the reduction was conducted at ambient temperature, bicyclic nitrile **10** was isolated in 28% yield along with diastereomerically pure **9** (27%). The relative configuration of both pyrrolizidines was deduced from the intense NOESY contacts between the four pseudoaxial protons in positions 1, 3, 5, and 7 located on the concave side of the roof-shaped azabicyclo-[3.3.0] framework.

The kinetic stability of compounds **3** under basic conditions is dependent on the absence of a substituent in the 2-position. While the condensation of aminoacetonitrile with suitable enones occurs spontaneously, the corresponding reaction of Strecker products derived from aliphatic or aromatic aldehydes requires the use of dehydrating agents (Scheme 3).

The $TiCl_4$/triethylamine system proved to be effective for all tested cases, while combinations with other Lewis acids such as $BF_3$-etherate or zinc chloride or the use of *N*-methylmorpholine instead of triethylamine gave inferior results.[25] The nature of the α-substituent turned out to have a profound influence on the reactivity of the condensation products **12**. If aminonitriles derived from aromatic aldehydes were used as the starting materials, imines **12** cyclized directly to the 2,3,5-trisubstituted 3,4-dihydro-2*H*-pyrrole-2-carbonitriles **14**. In contrast, α-substituents which do not

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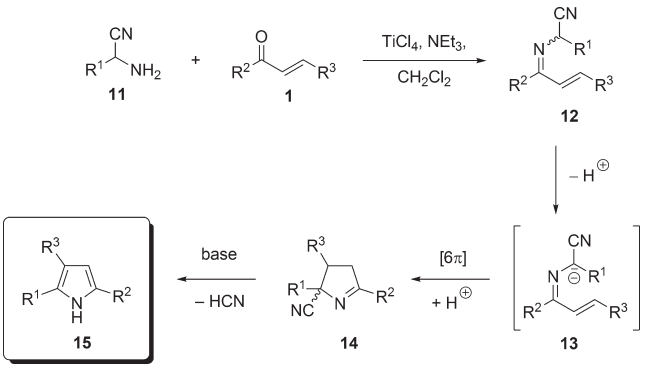
**SCHEME 3. General Reaction Course for the Formation of Pyrroles**




provide additional resonance stabilization had no such accelerating effect and alkyl-substituted ketimines **12** could be isolated as mixtures of geometric isomers. Presumably, the enhanced CH-acidity of the α-aryl substituted condensation product accounts for this behavior. Since intermediates **12** are sensitive to hydrolysis, they were preferably cyclized after an extractive workup without chromatographic purification. Elimination of HCN from cyanopyrroline **14a** with $Cs_2CO_3$ in refluxing THF gave pyrrole **15a** in a disappointingly low yield of only 15%, which could ultimately be increased to 61% by switching to potassium *tert*-butoxide in DMF under microwave heating to 100 °C. Under these conditions, cyclization of intermediates **12** to pyrroles **15** occurred as well (Scheme 4).

While the isolation of pyrrolines **14** is possible, the overall yield of the pyrrole synthesis was higher if the dehydrocyanation was performed on the crude products. Unfortunately, combination of the condensation and the cyclization/elimination in a one-pot protocol was unsuccessful as only slow and incomplete formation of the pyrroles **15** was observed. Using the optimized conditions for both steps, scope and limitations of the novel pyrrole synthesis were evaluated (Table 2).

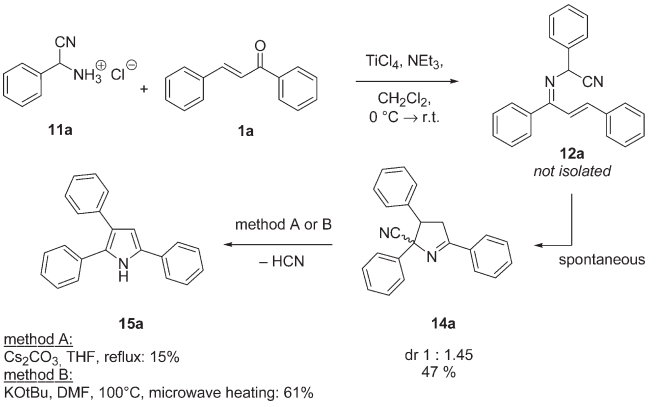
While their reaction modes differ, alkyl- and aryl-substituted α-aminonitriles roughly gave the same overall yields for a given enone. An aliphatic substituent $R^3$ was also tolerated (compare entries 2 and 13) while changing $R^2$ from aryl to alkyl had a deleterious effect. This may be due to the formation of enamines and concomitant C−C-bond formations in the condensation step. Although the overall

**TABLE 2. Synthesis of Pyrroles 15**

| entry | aminonitrile | $R^1$ | $R^2$ | $R^3$ | purified intermediate (dr, yield, %) | pyrrole | yield, % (over two steps) |
|---|---|---|---|---|---|---|---|
| 1 | **11a**[a] | Ph | Ph | Ph | **14a** (1:1.45, 47) | | |
| 2 | **11a**[a] | Ph | Ph | Ph | | **15a** | 41 |
| 3 | **11a** | Ph | 4-F-$C_6H_4$ | 4-MeO-$C_6H_4$ | | **15b** | 50 |
| 4 | **11a**[a] | Ph | 4-F-$C_6H_4$ | 2-Cl-$C_6H_4$ | | **15c** | 45 |
| 5 | **11b** | 4-F-$C_6H_4$ | Ph | Ph | | **15d** | 44 |
| 6 | **11c** | cyclohexyl | Ph | Ph | | **15e** | 38 |
| 7 | **11c** | cyclohexyl | 4-Cl-$C_6H_4$ | 3-$NO_2$-$C_6H_4$ | | **15f** | 34 |
| 8 | **11d**[a] | Me | Ph | Ph | **12g** (1:4, 33) | | |
| 9 | **11d**[a] | Me | Ph | Ph | | **15g** | 43 |
| 10 | **11d**[a] | Me | 4-Cl-$C_6H_4$ | 3-$NO_2$-$C_6H_4$ | | **15h** | 40 |
| 11 | **11d**[a] | Me | 4-F-$C_6H_4$ | 4-MeO-$C_6H_4$ | | **15i** | 40 |
| 12 | **11d**[a] | Me | 4-F-$C_6H_4$ | 2-Cl-$C_6H_4$ | | **15j** | 30 |
| 13 | **11a**[a] | Ph | Ph | Me | | **15k** | 31 |
| 14 | **11a**[a] | Ph | H | Ph | | **15l** | 21 |
| 15 | **11a**[a] | Ph | Me | Ph | | | [b] |
| 16 | **11a**[a] | Ph | Et | H | | | [b] |
| 17 | **11a**[a] | Ph | 2-benzylidenecyclohexanone | | | **15m** | 19[c] |

[a]Amino nitrile hydrochloride was used. [b]Complex mixture. [c]Contains impurities.

**SCHEME 4. Formation of Pyrrole 15a**




yield was somewhat lower, cinnamaldehyde turned out to be a suitable substrate and could be converted to 2,3-diphenylpyrrole (entry 14).

In summary, a facile and direct access to disubstituted cyanopyrrolines from enones and aminoacetonitrile hydrochloride has been found. The products may serve as starting materials for the preparation of various mono- and bicyclic N-heterocycles. When higher N-unsubstituted α-amino nitriles were used as the amine component, two- to tetrasubstituted pyrroles could be obtained in a two-step protocol based on the same cyclization reaction. Neither procedure involves expensive reagents or catalysts and all starting materials are readily available.

## Experimental Section

The α-aminonitriles **1a**−**e** were prepared according to literature procedures.[26−31]

**General Procedure for the Preparation of Cyanopyrrolines 3.** Finely ground aminoacetonitrile hydrochloride (1.5 equiv) and the corresponding α,β-unsaturated carbonyl compound (1 equiv) were suspended in pyridine. The resulting mixture was heated to reflux under stirring until the reaction was complete. If the electrophile was still present after 2 h as judged by TLC, another portion of aminoacetonitrile hydrochloride (0.5 equiv) was added. The addition was repeated until TLC indicated complete consumption of the starting material. The reaction mixture was diluted with ethyl acetate, washed with satd aq $NaHCO_3$, and dried over $Na_2SO_4$. Evaporation of the solvent in vacuo gave a crude product which was further purified by silica gel flash chromatography.

**3,5-Diphenyl-3,4-dihydro-2*H*-pyrrole-2-carbonitrile (3a)[20].** The title compound was prepared according to the general procedure from aminoacetonitrile hydrochloride (3.20 g, 34.6 mmol), chalcone (4.98 g, 23.9 mmol), and pyridine (100 mL). After a reaction time of 4 h, TLC indicated incomplete conversion, and a second portion of aminoacetonitrile hydrochloride (1.07 g, 12.0 mmol) was added. After another 4 h, the reaction mixture was worked up to yield a dark oil (7.45 g). Ratio of isomers: *trans*/*cis* = 3.0:1. Purification of the crude product by flash chromatography (cyclohexane/ethyl acetate, 10:1) gave *trans*-**3a** as yellow crystals (2.79 g, 47%): mp 69−70 °C dec (lit.[20] mp 74−76 °C); $R_f$ (cyclohexane/ethyl acetate 2:1) = 0.5 and *cis*-**3a** as yellow crystals (1.00 g, 17%), mp 103−104 °C dec, $R_f$ (cyclohexane/ethyl acetate 2:1) = 0.33.

*trans*-Isomer: IR (film) $\nu$ = 3062, 3030, 2244, 1611, 1576, 1496, 1449, 1346, 1028, 761, 693 $cm^{-1}$; $^1H$ NMR, COSY, HMBC (400 MHz, $CDCl_3$) $\delta$ = 7.89−7.93 (m, 2H, phenyl), 7.54 (mc, 1H, phenyl), 7.50−7.45 (m, 2H, phenyl), 7.40−7.35 (m, 2H, phenyl), 7.34−7.26 (m, 3H, phenyl), 4.94 (dt, 1H, $J_d$ = 7.2 Hz, $J_t$ = 1.9 Hz, H-2), 3.94 (d-pseudo-t, 1H, $J_d$ = 9.5 Hz, $J_t$ = 7 Hz, H-3), 3.69 (ddd, 1H, $J$ = 17.3, 9.5, 1.9 Hz, H-4a), 3.27 (ddd, 1H, $J$ = 17.3, 7.6, 1.9 Hz, H-4b); $^{13}C$ NMR, HMBC (100.6 MHz, $CDCl_3$) $\delta$ = 176.7 (C=N), 140.1, 132.6 (C-1′, C-1″), 131.9 (1C), 129.2 (2C), 128.7 (2C), 128.1 (2C), 127.8 (1C), 126.7 (2C), 119.2 (CN), 68.9 (C-2), 48.8 (C-3), 43.7 (C-4); FD-MS ($m/z$) = 246.1 (100) $[M]^+$; FAB-HRMS calcd for $[C_{17}H_{14}N_2+H]^+$ 247.1235; found 247.1231. Anal. Calcd for $C_{17}H_{14}N_2$ (246.31): C, 82.90; H, 5.73; N, 11.37. Found: C, 82.44; H, 5.87; N, 11.19.

*cis*-Isomer: IR (film) $\nu$ = 3062, 2246, 1665, 1607, 1576, 1496, 1449, 1346, 762, 694 $cm^{-1}$; $^1H$ NMR, COSY (400 MHz, $CDCl_3$) $\delta$ = 7.96−7.91 (m, 2H, phenyl), 7.54 (mc, 1H, phenyl), 7.51−7.46 (m, 2H, phenyl), 7.40−7.24 (m, 5H, phenyl), 5.33 (dt, 1H, $J_d$ = 8.5 Hz, $J_t$ = 1.2 Hz, H-2), 3.96 (dt, 1H, $J_t$ = 8.5 Hz, $J_t$ = 6.4 Hz, H-3), 3.52 (ddd, 1H, $J$ = 17.3, 8.5, 1.5 Hz, H-4a), 3.43 (ddd, 1H,

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$J$ = 17.3, 6.4, 1.5 Hz, H-4b); $^{13}$C NMR, DEPT (75.5 MHz, $CDCl_3$) $\delta$ = 177.7 (C=N), 138.6, 132.7 (C-1′, C-1″), 131.9 (1C), 128.9 (2C), 128.8 (2C), 128.1 (2C), 128.0 (1C), 127.5 (2C, phenyl), 117.0 (CN), 67.3 (C-2), 46.1 (C-3), 42.4 (C-4); FD-MS ($m/z$) = 246.1 (100) $[M]^+$. Anal. Calcd for $C_{17}H_{14}N_2$ (246.31): C, 82.90; H, 5.73; N, 11.37. Found: C, 82.71; H, 5.70; N, 11.06.

**5-(4-Fluorophenyl)-3-(4-methoxyphenyl)-3,4-dihydro-2*H*-pyrrole-2-carbonitrile (3b).** The title compound was prepared according to the general procedure from aminoacetonitrile hydrochloride (108 mg, 1.17 mmol), 4-methoxy-4′-fluorochalcone (197 mg, 0.77 mmol), and pyridine (3.2 mL). After 19 h, TLC did not indicate complete conversion, and another portion of aminoacetonitrile hydrochloride (36 mg, 0.39 mmol) was added. After another 21 h, workup produced a black oil (237 mg). Ratio of isomers: *trans*/*cis* = 2.9:1. Purification of the crude product by flash chromatography (cyclohexane/ethyl acetate, 10:1 + 1% $EtNMe_2$) gave *trans*-**3c** as a yellow oil (95 mg, 42%): $R_f$ (cyclohexane/ethyl acetate 10:1) = 0.20 and *cis*-**3c** as a yellow oil (26 mg, 11%), $R_f$ (cyclohexane/ethyl acetate 10:1) = 0.06.

*trans*-Isomer: IR (film) $\nu$ = 3005, 2936, 2838, 2245, 1603, 1513, 1253, 1034, 838 cm$^{-1}$; $^1$H NMR (300 MHz, $CDCl_3$) $\delta$ = 7.90 (mc, 2H, H-3′,5′), 7.11−7.21 (m, 4H, H-2′,6′, H-4″,6″), 6.90 (mc, 2H, H-3″,5″), 4.86 (dt, 1H, $J_d$ = 7.1 Hz, $J_t$ = 1.9 Hz, H-2), 3.90 (d-pseudo-t, 1H, $J_d$ = 9.4 Hz, $J_t \approx$ 7 Hz, H-3), 3.81 (s, 3H, $OCH_3$), 3.63 (ddd, 1H, $J$ = 17.3, 9.4, 1.9 Hz, H-4a), 3.19 (ddd, 1H, $J$ = 17.3, 7.4, 1.9 Hz, H-4b); $^{13}$C NMR (75.6 MHz, $CDCl_3$) $\delta$ = 175.4 (C-5), 166.5 ($^1J_{C,F}$ = 253.7 Hz, C-4′), 159.1 (C-4″), 131.8 (C-1″), 130.4 ($^3J_{C,F}$ = 8.8 Hz, C-2′,6′), 129.1 ($^4J_{C,F}$ = 3.2 Hz, C-1′), 127.7 (C-2″, 6″), 119.2 (CN), 115.8 ($^2J_{C,F}$ = 21.9 Hz, C-3′, 5′), 114.5 (C-3″, 5″), 69.0 (C-2), 55.3 ($OCH_3$), 48.3 (C-3), 43.7 (C-4); ESI-MS $m/z$ = 336.1 $[M + H + MeCN]^+$ (7), 295.1 $[M + H]^+$ (100), 268.0 $[M - CN]^+$ (32); ESI-HRMS calcd for $[C_{18}H_{15}FN_2O + H]^+$ 295.1247, found 295.1240.

*cis*-Isomer: $^1$H NMR (300 MHz, $CDCl_3$) $\delta$ = 8.02 (mc, 2H, H-3′,5′), 7.36 (mc, 2H, H-2′,6′), 7.18 (mc, 2H, H-4″,6″), 6.91 (mc, 2H, H-3″,5″), 5.60 (br d, 1H, $J$ = 8.1 Hz, H-2), 3.98 (d-pseudo-t, 1H, $J_t \approx$ 8 Hz, $J_d$ = 6.3 Hz, H-3), 3.73 (s, 3H, $OCH_3$), 3.52 (ddd, 2H, $J$ = 17.4, 8.5, 1.2 Hz, H-4a), 3.38 (ddd, 1H, $J$ = 17.4, 6.3, 1.2 Hz, 4b); $^{13}$C NMR (75.5 MHz, $CDCl_3$) $\delta$ = 176.6 (C-5), 164.3 ($^1J_{C,F}$ = 249.7 Hz, C-4′), 158.6 (C-4″), 131.7 (C-1″), 130.8 ($^3J_{C,F}$ = 9.0 Hz, C-2′,6′), 129.6 ($^4J_{C,F}$ = 3.0 Hz, C-1′), 128.8 (C-2″, 6″), 118.2 (CN), 116.0 ($^2J_{C,F}$ = 21.9 Hz, C-3′, 5′), 114.0 (C-3″, 5″), 66.9 (C-2), 55.1 ($OCH_3$), 44.5 (C-3), 41.9 (C-4); ESI-MS $m/z$ = 317.1 $[M + K]^+$ (20), 295.1 $[M + H]^+$ (20), 273.2 (100); ESI-HRMS calcd for $[C_{18}H_{15}FN_2O + H]^+$ 295.1247, found 295.1238.

**5-Phenyl-3-(4-cyanophenyl)-3,4-dihydro-2*H*-pyrrole-2-carbonitrile (3c).** The title compound was prepared according to the general procedure from aminoacetonitrile hydrochloride (166 mg, 1.82 mmol), 4-cyanochalcone[32] (205 mg, 0.88 mmol), and pyridine (3.2 mL) in 17 h. Workup yielded a black oil (245 mg). Ratio of isomers: *trans*/*cis* = 2.4:1. Purification of the crude product by flash chromatography (cyclohexane/ethyl acetate, 10:1) gave *trans*-**3c** as a yellow oil (95 mg, 40%), $R_f$ (cyclohexane/ethyl acetate 10:1) = 0.24 and *cis*-**3c** as a yellow oil (32 g, 13%), $R_f$ (cyclohexane/ethyl acetate 10:1) = 0.09.

*trans*-Isomer: IR (film) $\nu$ = 3068, 2926, 2360, 2341, 2254, 2232, 1612, 1345, 1074, 909 cm$^{-1}$; $^1$H NMR (300 MHz, $CDCl_3$) $\delta$ = 7.86 (mc, 2H, H-2″,6″), 7.65 (mc, 2H, H-2′,6′), 7.43−7.56 (m, 3H, H-3″,4″,5″), 7.38 (mc, 2H, H-3′,5′), 4.92 (dt, 1H, $J_d$ = 7.0 Hz, $J_t$ = 1.7 Hz, H-2), 4.00 (d-pseudo-t, 1H, $J_d$ = 9.5 Hz, $J_t \approx$ 7 Hz, H-3), 3.74 (ddd, 1H, $J$ = 17.4, 9.5, 1.7 Hz, H-4a), 3.25 (ddd, 1H, $J$ = 17.4, 7.4, 1.7 Hz, H-4b); $^{13}$C NMR (75.5 MHz, DMSO) $\delta$ = 176.4 (C-5), 145.3 (C-1′), 133.0 (C-3′,5′), 132.2 (C-4″, C-1″), 128.8 (2C), 128.2 (2C), 127.6 (2C), 118.5 (CN), 118.2 (CN), 111.9 (C-4′), 68.5 (C-2), 48.7 (C-3), 43.5 (C-4); ESI-MS $m/z$ (%) = 543.3 $[2M + H]^+$ (7), 313.1 $[M + H + MeCN]^+$ (11), 272.1 $[M + H]^+$ (62), 245.1 $[M - CN]^+$ (100); ESI-HRMS calcd for $[C_{18}H_{13}N_3 + H]^+$ 272.1188; found 272.1180.

*cis*-Isomer: IR (film) $\nu$ = 3156, 2927, 2360, 2341, 2254, 2232, 1611, 1345, 1062, 908 cm$^{-1}$. $^1$H NMR (300 MHz, $CDCl_3$) $\delta$ = 7.89 (mc, 2H, H-2″,6″), 7.63 (mc, 2H, H-2′,6′), 7.44−7.57 (m, 3H, H-3″,4″,5″), 7.34 (mc, 2H, H-3′,5′), 5.36 (dt, 1H, $J_d$ = 8.2 Hz, $J_t$ = 1.5 Hz, H-2), 4.02 (d-pseudo-t, 1H, $J_t \approx$ 8 Hz, $J_d$ = 5.7 Hz, H-3), 3.57 (ddd, 1H, $J$ = 17.4, 8.5, 1.5 Hz, H-4a), 3.40 (ddd, 1H, $J$ = 17.4, 5.7, 1.5 Hz, H-4b); $^{13}$C NMR (75.5 MHz, $CDCl_3$) $\delta$ = 177.3 (C-5), 144.2 (C-1′), 132.7 (C-3′,5′), 132.2 (C-4″, 1″), 128.8 (2C), 128.4 (2C), 128.2 (2C) (C-4′,6′, C-2″,6″, C-3″,5″), 118.4 (CN), 116.6 (CN), 112.0 (C-4′), 67.0 (C-2), 46.0 (C-3), 42.5 (C-4); ESI-MS $m/z$ (%) = 272.1 $[M + H]^+$ (24), 245.1 $[M - CN]^+$ (100); ESI-HRMS calcd for $[C_{18}H_{13}N_3 + H]^+$ 272.1188; found 272.1186.

**5-(4-Chlorophenyl)-3-(3-nitrophenyl)-3,4-dihydro-2*H*-pyrrole-2-carbonitrile (3d).** The title compound was prepared according to the general procedure from aminoacetonitrile hydrochloride (192 mg, 2.07 mmol), 4′-chloro-3-nitrochalcone (397 mg, 1.38 mmol), and pyridine (5.8 mL). After 3 h, TLC indicated incomplete conversion, and another portion of aminoacetonitrile hydrochloride (65 mg, 0.70 mmol) was added. After another 2 h, workup yielded a black oil (560 mg). Ratio of isomers: *trans*/*cis* = 2.6:1. Purification of the crude product by flash chromatography (cyclohexane/ethyl acetate, 5:1) gave *trans*-**3d** as yellow crystals (277 mg, 0.85 mmol, 62%), mp 169.5−170.5 °C (dec), $R_f$ (cyclohexane/ethyl acetate 2:1) = 0.38 and *cis*-**3d** as orange crystals (80 mg, 0.38 mmol, 28%), mp 178−179 °C (dec), $R_f$ (cyclohexane/ethyl acetate 2:1) = 0.15.

*trans*-Isomer: IR (film) $\nu$ = 2958, 2919, 1611, 1597, 1530, 1351, 1093, 906, 735 cm$^{-1}$; $^1$H NMR (400 MHz, $CDCl_3$) 8.19 (dt, $J_d$ = 7.7 Hz, $J_t$ = 1.7 Hz, 1H, H-4′), 8.14 (t, $J$ = 1.7 Hz, 1H, H-2′), 7.83 (AA′-part of AA′BB′-system, 2H, H-2″,6″), 7.62 (d, $J_d$ = 7.7 Hz, 1H, H-6′), 7.59 (t, $J_t$ = 7.8 Hz, 1H, H-5′), 7.44 (BB′-part of a AA′BB′-system, 2H, H-3″,5″), 4.93 (dt, $J_d$ = 7.3 Hz, $J_t$ = 1.6 Hz, 1H, H-2), 4.06 (d-pseudo-t, $J_d$ = 9.2 Hz, $J_t \approx$ 7 Hz, 1H, H-3), 3.73 (ddd, $J$ = 17.2, 9.2, 1.6 Hz, 1H, H-4a), 3.25 (ddd, $J$ = 17.2, 7.7, 1.6 Hz, 1H, H-4b);$^{13}$C NMR (400 MHz, $CDCl_3$) $\delta$ = 175.5 (C-5), 149.1 (aryl-$C_q$), 142.0 (aryl-$C_q$), 138.8 (aryl-$C_q$), 133.4 (aryl-CH), 131.0 (aryl-$C_q$) 130.7 (aryl-CH), 129.8 (C-2′,6′), 129.4 (C-3′, 5′), 123.3 (aryl-CH), 121.8 (aryl-CH), 118.6 (CN), 68.9 (C-2), 48.9 (C-3), 43.7 (C-4); FAB-MS ($m/z$) 325 (100) $[M]^+$, 176 (94); ESI-HRMS calcd for $[C_{17}H_{12}ClN_3O_2 + H]^+$ 326.0696, found 326.0692.

*cis*-Isomer: IR (film) $\nu$ = 2927, 1605, 1597, 1529, 1348, 1093, 907, 731 cm$^{-1}$; $^1$H NMR (400 MHz, $CDCl_3$) $\delta$ = 8.18 (dt, $J_t$ = 2.3, Hz, $J_d$ = 6.4 Hz, 1H, H-4′), 8.11 (br s, 1H, H-2′), 7.86 (mc, part of a AA′BB′-system, 2H, H-2″,6″), 7.54−7.59 (m, 2H, H-5′, 6′), 7.47 (mc, part of a AA′BB′-system, 2H, H-3″,5″), 5.38 (dt, $J_d$ = 8.4 Hz, $J_t$ = 1.5 Hz, 1H, H-2), 4.09 (d-pseudo-t, $J_t \approx$ 9 Hz, $J_d$ = 6.2 Hz, 1H, H-3), 3.57 (ddd, $J$ = 17.3, 8.8, 1.1 Hz, 1H, H-4a), 3.41 (ddd, $J$ = 17.3, 6.2, 1.1 Hz, 1H, H-4b); $^{13}$C NMR (101 MHz, $CDCl_3$) $\delta$ = 176.5 (C-5), 148.6 (C-3′), 140.8 (aryl-$C_q$), 138.9 (aryl-$C_q$), 133.7 (aryl-CH), 131.0 (aryl-$C_q$), 130.4 (aryl-CH), 129.8 (C-2″,6″), 129.5 (C-3″,5″), 123.5 (aryl-CH), 123.0 (aryl-CH), 116.6 (CN), 67.3 (C-2), 46.1 (C-3), 42.6 (C-4); FAB-MS ($m/z$) 326 (84) $[M + H]^+$, 178 (100); ESI-HRMS calcd for $[C_{17}H_{12}ClN_3O_2 + Na]^+$ 348.0516, found 348.0519. Anal. Calcd for $C_{17}H_{12}ClN_3O_2$ (325.75): C, 62.68; H, 3.71; N, 12.90. Found: C, 62.35; H, 3.45; N, 12.83.

**5-(2-Naphthyl)-3-phenyl-3,4-dihydro-2*H*-pyrrole-2-carbonitrile (3e).** The title compound was prepared according to the general procedure from aminoacetonitrile hydrochloride (173 mg, 1.87 mmol), (*E*)-1-(2-naphthyl)-3-phenylpropenone[33]

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(370 mg, 1.25 mmol), and pyridine (5.8 mL). After 2 h, TLC indicated incomplete conversion, and another portion of aminoacetonitrile hydrochloride (60 mg, 0.65 mmol) was added. This was repeated after 3 h. After a further 3 h, workup yielded a black oil (475 mg). Ratio of isomers: *trans*/*cis* = 3.3:1. Purification of the crude product by flash chromatography (cyclohexane/ethyl acetate, 15:1) gave *trans*-**3e** as a yellow oil (46 mg, 0.16 mmol, 13%): $R_f$ (cyclohexane/ethyl acetate 2:1) = 0.5, *cis*-**3e** as a brown oil (51 mg, 0.17 mmol, 14%), $R_f$ (cyclohexane/ethyl acetate 2:1) = 0.36 and a mixture of both isomers (trans/cis = 10/0.08, 235 mg, 63%).

*trans*-Isomer: IR (film) $\nu$ = 3060, 3031, 2242, 1608, 752, 670 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) $\delta$ = 8.21 (s, 1H, H-1′), 8.12 (dd, $J$ = 8.7, 1.6 Hz, 1H, naphth), 7.94−7.84 (m, 3H, naphth), 7.55 (mc, 2H, naphth), 7.28−7.39 (m, 5H, Ph), 4.97 (dt, $J_d$ = 7.1 Hz, $J_t$ = 1.7 Hz, 1H, H-2), 3.98 (d-pseudo-t, $J_d$ = 9.4 Hz, $J_t \approx$ 7 Hz, 1H, H-3), 3.81 (ddd, $J$ = 17.2, 9.4, 1.7 Hz, 1H, H-4a), 3.38 (ddd, $J$ = 17.2, 7.5, 1.7 Hz, 1H, H-4b); $^{13}C$ NMR (125.75 MHz, $CDCl_3$) $\delta$ = 176.9 (C-5), 140.3 (aryl-$C_q$), 135.2 (aryl-$C_q$), 132.9 (aryl-$C_q$), 130.4 (aryl-$C_q$), 129.7 (aryl-CH), 129.5 (2C, Ph-CH), 129.1 (aryl-CH), 128.8 (aryl-CH), 128.2 (aryl-CH), 128.1 (aryl-CH), 128.1 (2C, Ph-CH), 127.0 (aryl-CH), 126.9 (2C, Ph-CH), 124.5 (aryl-CH), 119.5 (CN), 69.2 (C-2), 49.1 (C-3), 43.9 (C-4); FAB-MS (*m*/*z*) 296 (57) $[M]^+$, 269 (32) $[M - HCN]^+$, 192 (100), 127 (72) $[C_{10}H_7]^+$; ESI-HRMS calcd for $[C_{21}H_{16}N_2 + H]^+$ 297.1392, found 297.1398.

*cis*-Isomer: IR (film) $\nu$ = 3060, 3031, 2956, 2924, 1608, 750, 699, 477 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) $\delta$ = 8.25 (s, 1H, H-1′), 8.14 (dd, $J$ = 8.6, 1.6 Hz, 1H, naphth), 7.87−7.92 (m, 3H, naphth), 7.56 (mc, 2H, naphth), 7.39−7.25 (m, 5H, Ph), 5.36 (dt, $J_d$ = 8.2 Hz, $J_t$ = 1.5 Hz, 1H, H-2), 3.98 (d-pseudo-t, $J_t \approx$ 8 Hz, $J_d$ = 6.4 Hz, 1H, H-3), 3.61 (ddd, $J$ = 17.2, 8.4, 1.5 Hz, 2H, H-4a), 3.54 (ddd, $J$ = 17.2, 6.4, 1.5 Hz, 1H); $^{13}C$ NMR (100.75 MHz, $CDCl_3$) $\delta$ = 177.9 (C-5), 139.0 (aryl-$C_q$), 135.2 (aryl-$C_q$), 133.0 (aryl-$C_q$), 130.5 (aryl-$C_q$), 129.7 (aryl-CH), 129.2 (C-3″,5″), 129.1 (aryl-CH), 128.8 (aryl-CH), 128.2 (aryl-CH), 128.2 (aryl-CH), 128.1 (aryl-CH), 127.7 (C-2″,6″), 127.0 (aryl-CH), 124.5 (aryl-CH), 117.3 (CN), 67.6 (C-2), 46.4 (C-3), 42.6 (C-4); FAB-MS (*m*/*z*) 296 (47) $[M]^+$, 269 (18) $[M - HCN]^+$, 192 (100), 127 (39) $[C_{10}H_7]^+$; FAB-HRMS calcd for $[C_{21}H_{16}N_2 + H]^+$ 297.1392, found 297.1380.

**3-(2-Bromophenyl)-5-(2-naphthyl)-3,4-dihydro-2*H*-pyrrole-2-carbonitrile (3f).** The title compound was prepared according to the general procedure from aminoacetonitrile hydrochloride (135 mg, 1.46 mmol), 3-(2-bromophenyl)-1-(2-naphthyl)propenone[34] (329 mg, 0.98 mmol), and pyridine (4 mL). After 3 h, TLC indicated incomplete conversion and another portion of aminoacetonitrile hydrochloride (45 mg, 0.48 mmol) was added. After a further 3 h, workup yielded a black oil (381 mg). Ratio of isomers: *trans*/*cis* = 2.7:1. Purification of the crude product by flash chromatography (cyclohexane/ethyl acetate, 5:1) gave *trans*-**3f** as yellow crystals (22 mg, 0.059 mmol, 6%): mp 148−149 °C (dec), $R_f$ (cyclohexane/ethyl acetate 2:1) = 0.49 and a mixture of *cis*- and *trans*-**3f** as yellow crystals (trans/cis = 2.5/1, 261 mg, 0.70 mmol, 71%), $R_f$ *cis* (cyclohexane/ethyl acetate 2:1) = 0.43.

*trans*-Isomer: $^1H$ NMR (400 MHz, $CDCl_3$) $\delta$ = 8.22 (s, 1H, H-1′), 8.12 (dd, $J$ = 8.6, 1.7 Hz, 1H, naphth), 7.94−7.84 (m, 3H, naphth), 7.63 (dd, $J$ = 8.0, 1.0 Hz, 1H, H-3′), 7.55 (mc, 2H, naphth), 7.27 (dt, $J_t$ = 6.4 $J_d$ = 1.0 Hz, 1H, H-5′), 7.19−7.10 (m, 2H, H-4′, H-6′), 5.15 (dt, $J_d$ = 5.6 Hz, $J_t$ = 1.5 Hz, 1H, H-2), 4.48 (dt, $J_d$ = 9.6 Hz, $J_t$ = 5.6 Hz, 1H, H-3), 3.84 (ddd, $J$ = 17.5, 9.6, 1.5 Hz, 1H, H-4a), 3.41 (ddd, $J$ = 17.5, 5.6, 1.5 Hz, 1H, H-4b); $^{13}C$ NMR (101 MHz, $CDCl_3$) $\delta$ = 177.1 (C-5), 139.9 (aryl-$C_q$), 135.3 (aryl-$C_q$), 133.9 (aryl-$C_q$), 133.0 (aryl-$C_q$), 130.3 (aryl-$C_q$), 129.8 (aryl-CH), 129.5 (aryl-CH), 129.2 (aryl-CH), 128.9 (aryl-CH), 128.5 (aryl-CH), 128.2 (aryl-CH), 128.1 (aryl-CH), 127.7 (aryl-CH), 127.1 (aryl-CH), 124.6 (aryl-CH), 124.4 (C-2′), 119.0 (CN), 67.8 (C-2), 47.7 (C-3), 43.4 (C-4); FAB-MS *m*/*z* 376.2/374.2 (90/91) $[M]^+$, 349.1/347.1 (12/12) $[M - HCN]^+$, 323.2/321.2 (8/9), 293.2 (51), 192.2 (100), 127.2 (58) $[C_{10}H_7]^+$; FAB-HRMS calcd for $[C_{21}H_{15}BrN_2 + H]^+$ 375.0497, found 375.0484. Anal. Calcd for $C_{21}H_{15}BrN_2$ (374.04): C, 67.21; H, 4.03; N, 7.47. Found: C, 67.12; H, 4.02; N, 7.25.

Characteristic data of the *cis*-isomer: $^1H$ NMR (400 MHz, $CDCl_3$) $\delta$ = 8.25 (s, 1H, H-1′), 5.55 (dt, $J_d$ = 8.5 Hz, $J_t$ = 1.2 Hz, 1H, H-2), 3.61 (dd, $J$ = 1.4, 4.1, 1H, H-4a), 3.59 (dd, $J$ = 1.4, 3.0, 1H, H-4b); $^{13}C$ NMR (101 MHz, $CDCl_3$) $\delta$ = 177.5 (C-5), 137.7 (aryl-$C_q$), 133.5 (aryl-CH), 133.0 (aryl-$C_q$),130.5 (aryl-$C_q$), 129.8 (aryl-CH), 129.7 (aryl-CH), 129.2 (aryl-CH), 128.9 (aryl-CH), 128.4 (aryl-CH), 128.2 (aryl-CH), 128.1 (aryl-CH), 128.1 (aryl-CH), 127.7 (aryl-CH), 127.1 (aryl-CH), 124.5 (aryl-CH), 124.4 (C-1′), 119.0 (CN), 66.2 (C-2), 45.5 (C-3), 41.4 (C-4).

**5-(Benzo[*b*]furan-2-yl)-3-phenyl-3,4-dihydro-2*H*-pyrrole-2-carbonitrile (3g).** The title compound was prepared according to the general procedure from aminoacetonitrile hydrochloride (133 mg, 1.45 mmol), (*E*)-1-(benzo[*b*]furan-2-yl)-3-phenylpropenone (244 mg, 0.98 mmol), and pyridine (4.2 mL). After 2 h, TLC indicated incomplete conversion, and another portion of aminoacetonitrile hydrochloride (50 mg, 0.54 mmol) was added. This was repeated after 2 h. After a further 2 h, workup yielded a black oil (323 mg). Ratio of isomers: *trans*/*cis* = 3.3:1. Purification of the crude product by flash chromatography (cyclohexane/ethyl acetate, 5:1) gave *trans*-**3g** as yellow crystals (123 mg, 0.42 mmol, 44%): mp 137−138 °C dec, $R_f$ (petroleum ether/ethyl acetate 2:1) = 0.61 and *cis*-**3g** as a brown oil (58 mg, 0.20 mmol, 20%), $R_f$ (petroleum ether/ethyl acetate 2:1) = 0.54.

*trans*-Isomer: IR (film) $\nu$ = 3050, 3032, 2243, 1616, 1052, 751, 699 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) $\delta$ = 7.66 (d, $J$ = 7.8 Hz, 1H, H-4′), 7.58 (d, $J$ = 8.4 Hz, 1H, H-7′), 7.43 (t, $J$ = 7.8 Hz, 1H, H-5′), 7.25−7.38 (m, 7H, aryl-CH), 4.97 (dt, $J_d$ = 7.1 Hz, $J_t$ = 1.8 Hz, 1H, H-2), 3.96 (d-pseudo-t, $J_d$ = 9.3 Hz, $J_t \approx$ 7.4 Hz, 1H, H-3), 3.69 (ddd, $J$ = 17.4, 9.5, 1.8 Hz, 1H, H-4a), 3.28 (ddd, $J$ = 17.4, 7.7, 1.8 Hz, 1H, H-4b); $^{13}C$ NMR (101 MHz, $CDCl_3$) $\delta$ = 168.1 (C-5), 156.1 (C-7a′), 149.4 (C-2′), 139.7 (C-1″), 129.6 (2C, Ph), 128.2 (aryl-CH), 127.7 (aryl-CH), 127.6 (C-3a′), 127.0 (2C, Ph), 124.0 (aryl-CH), 122.6 (aryl-CH), 118.9 (CN), 112.4 (2C, aryl-CH), 69.4 (C-2), 49.0 (C-3), 43.8 (C-4); FAB-MS *m*/*z* 286 (91) $[M]^+$, 259 (5) $[M - HCN]^+$, 233 (14), 182 (100); FAB-HRMS calcd for $[C_{19}H_{14}N_2O + H]^+$ 287.1184, found 287.1168. Anal. Calcd for $C_{19}H_{14}N_2O$ (286.33): C, 79.70; H, 4.93; N, 9.78. Found: C, 79.68; H, 4.81; N, 9.80.

*cis*-Isomer: IR (film) $\nu$ = 3064, 3029, 2936, 2241, 1617, 753, 700 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) $\delta$ = 7.67 (d, $J$ = 7.8 Hz, 1H, H-4′), 7.59 (d, $J$ = 8.4 Hz, 1H, H-7′), 7.43 (mc, 1H, H-5′), 7.40−7.24 (m, 7H, aryl-CH), 5.36 (d-pseudo-t, $J_d$ = 8.2 Hz, $J_t \approx$ 1.6 Hz, 1H, H-2), 3.97 (d-pseudo-t, $J_t \approx$ 8.3 Hz, $J_d$ = 6.4 Hz, 1H, H-3), 3.52 (ddd, $J$ = 17.3, 8.5, 1.5 Hz, 1H, H-4a), 3.44 (ddd, $J$ = 17.3, 6.4, 1.6 Hz, 1H, H-4b); $^{13}C$ NMR, DEPT (101 MHz, $CDCl_3$) $\delta$ = 169.0 (C-5), 156.1 (C-7a′), 149.5 (C-2′), 138.3 (C-1″), 129.2 (2C, Ph), 128.4 (aryl-CH), 127.7 (3C, aryl-CH), 127.6 (C-3a′), 124.0 (aryl-CH), 122.6 (aryl-CH), 116.7 (CN), 112.5 (aryl-CH), 112.4 (aryl-CH), 67.7 (C-2), 46.3 (C-3), 42.5 (C-4); FAB-MS *m*/*z* 286 (100) $[M]^+$, 182 (89); FAB-HRMS calcd for $[C_{19}H_{14}N_2O + H]^+$ 287.1184, found 287.1190.

**(*E*)-3-(4-Chlorophenyl)-5-(4-chlorostyryl)-3,4-dihydro-2*H*-pyrrole-2-carbonitrile (3h).** The title compound was prepared according to the general procedure from aminoacetonitrile hydrochloride (202 mg, 2.16 mmol), (*E*,*E*)-1,5-bis(4-chlorophenyl)-penta-1,4-dien-2-one[35,36] (449 mg, 1.48 mmol), and pyridine (6.3 mL). After 3 h, TLC did not indicate complete conversion, and another portion of aminoacetonitrile hydrochloride (70 mg, 0.76 mmol) was added. Workup after 1 h

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yielded a black oil (615 mg). Ratio of isomers: *trans*/*cis* = 2.8:1. Purification of the crude product by flash chromatography (cyclohexane/ethyl acetate, 5:1) gave *trans*-**3h** as orange crystals (150 mg, 0.44 mmol, 30%): mp 134−136 °C (dec), $R_f$ (cyclohexane/ethyl acetate 2:1) = 0.38 and a mixture of *cis* and *trans*-**3h** as red oil (40 mg, 0.12 mmol, 8%, *cis*/*trans* = 1.25:1), $R_f$ (cyclohexane/ethyl acetate 2:1) = 0.14.

*trans*-Isomer: IR (film) $\nu$ = 3051, 3031, 2243, 1633, 1580, 1492, 1407, 1352, 1091, 1013, 812, 731 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) $\delta$ = 7.43 (mc, 2H, aryl-H), 7.34 (mc, 4H, aryl-H), 7.17 (mc, 2H, aryl-H), 7.04 (br s, 2H, styryl-H), 4.79 (dt, $J_d$ = 7.0 Hz, $J_t$ = 1.6 Hz, 1H, H-2), 3.83 (d-pseudo-t, $J_d$ = 9.3 Hz, $J_t \approx 7$ Hz, 1H, H-3), 3.49 (ddd, $J$ = 17.1, 9.3, 1.6 Hz, 1H, H-4a), 3.01 (ddd, $J$ = 17.1, 7.6, 1.6 Hz, 1H, H-4b); $^{13}C$ NMR, DEPT (126 MHz, $CDCl_3$) $\delta$ = 176.7 (C-5), 140.7 (styryl-C2), 138.4 ($C_q$), 136.0 ($C_q$), 133.8 ($C_q$), 133.4 ($C_q$), 129.4 (2C, aryl-CH), 129.3 (2C, aryl-CH), 128.8 (2C, aryl-CH), 128.1 (2C, aryl-CH), 123.5 (styryl-C1), 118.8 (CN), 68.5 (C-2), 48.1 (C-3), 42.4 (C-4); FAB-MS *m*/*z* 339 (100) $[M - H]^+$, 167 (60); FAB-HRMS calcd for $[C_{19}H_{14}Cl_2N_2 + H]^+$ 341.0612, found 341.0597.

Characteristic data of the *cis*-isomer: $^1H$ NMR (400 MHz, $CDCl_3$) $\delta$ = 7.07 (s, 2H, styryl-H), 5.22 (dt, $J_d$ = 8.1 Hz, $J_t$ = 1.2 Hz, 1H, H-2), 3.30 (ddd, $J$ = 17.0, 8.6, 1.2 Hz, 1H, H-4a), 3.17 (ddd, $J$ = 17.0, 6.1, 1.2 Hz, 1H, H-4b); $^{13}C$ NMR, DEPT (126 MHz, $CDCl_3$) $\delta$ = 177.7 (C-5), 140.9 (styryl-C2), 137.1 ($C_q$), 136.0 ($C_q$), 134.0 ($C_q$), 133.4 ($C_q$), 129.3 (aryl-CH), 129.2 (aryl-CH), 128.87, 128.84 (2 × aryl-$CH^c$), 128.81 (aryl-$CH^t$), 123.6 (styryl-C1), 116.8 (CN), 66.9 (C-2), 45.4 (C-3), 41.3 (C-4)ppm.

Data of isomeric mixture: IR (film) 2927, 2805, 2240, 1633, 1579, 1491, 1407, 1351, 1090, 1012, 970, 907, 811, 728 $cm^{-1}$; FAB-MS *m*/*z* 339 (100) $[M - H]^+$, 313(12) $[M - HCN]^+$, 167 (54). Anal. Calcd for $C_{19}H_{14}Cl_2N_2$ (341.23): C, 62.68; H, 3.71; N, 12.90. Found: C, 62.64; H, 3.45; N, 12.83.

**5-(4-Fluorophenyl)-3-(2-chlorophenyl)-3,4-dihydro-2*H*-pyrrole-2-carbonitrile (3i).** The title compound was prepared according to the general procedure from aminoacetonitrile hydrochloride (150 mg, 1.62 mmol), 2-chloro-4′-fluorochalcone (281 mg, 1.08 mmol), and pyridine (4.7 mL). After 2 h, TLC indicated incomplete conversion, and another portion of aminoacetonitrile hydrochloride (52 mg, 0.56 mmol) was added. After a further 1.5 h, workup yielded a black oil (374 mg). Ratio of isomers: *trans*/*cis* = 1.3:1. Purification of the crude product by flash chromatography (cyclohexane/ethyl acetate, 10:1) only gave an isomeric mixture of **3i** as a yellow oil (248 mg, 0.83 mmol, 77%, *trans*/*cis*: 1.25:1), $R_f$ *trans* (cyclohexane/ethyl acetate 2:1) = 0.45, $R_f$ *cis* (cyclohexane/ethyl acetate 2:1) = 0.39.

Data of isomeric mixture: $^1H$ NMR (400 MHz, $CDCl_3$) $\delta$ = 7.87−7.94 (m, 2H, H-$2^{c,t}$, $2''^{c,t}$,$6''^{c,t}$), 7.40−7.46 (m, 1H, H-$3'^{c,t}$), 7.22−7.30 (m, 2H, aryl-H), 7.11−7.17 (m, 3H, aryl-H), 5.48 (td, 0.45H, $J_d$ = 8.2 Hz, $J_t$ = 1.4 Hz, H-$2^c$), 5.10 (d, 0.55H, $J_d$ = 6.0 Hz, $J_t$ = 1,2 Hz, H-$2^t$), 4.48 (q, 0.45H, $J$ = 8.1 Hz, 1H, H-$3^c$), 4.38 (dt, 0.55H, $J_t$ = 9.7 Hz, $J_d$ = 6.0 Hz, H-$3^t$), 3.67 (ddd, $J$ = 17.6, 9.7, 1.8 Hz, 0.55H, H-$4a^t$), 3.46 (dd, 0.9H, $J$ = 8.1 Hz, $J$ = 1.4 Hz, 2H, H-4a,$b^c$), 3.27 (ddd, 0.55H, $J$ = 17.6, 6.2, 1.4 Hz, 1H, H-$4b^t$); $^{13}C$ NMR (101 MHz, $CDCl_3$) $\delta$ = 176.5 (C-$5^c$), 175.7 (C-$5^t$), 166.6 ($^1J_{C,F}$ = 253.1 Hz, C-$4^{c,t/''}$),137.7 (C-$1'^t$), 135.7 (C-$1'^c$), 134.5 (C-$2'^c$), 133.9 (C-$2'^t$), 130.8 ($C^t$), 130.70 (1C), 130.68 (2C), 130.6 ($C^c$), 130.2 ($C^t$), 129.5 ($C^c$), 129.3($C^t$) (C-$3'^t$, C-$4'^t$, C-$5'^t$, C-$6'^t$, C-$3'^c$, C-$4'^c$, C-$5'^c$, C-$6'^c$) 128.0 ($C^t$), 127.9 ($C^c$), 127.9 ($C^t$), 127.7 ($C^c$) (C-$2''$, $6''^t$, C-$2''$, $6''^c$), 119.0 ($CN^t$), 116.7 ($CN^c$), 116.2 ($^2J_{C,F}$ = 22.1 Hz, C-$3''$,$5''^t$), 116.2 ($^2J_{C,F}$ = 22.1 Hz, C-$3''$,$5''^c$), 115.8, 115.6 (C-$1''^{c,t}$), 67.4 (C-$2^t$), 66.0 (C-$2^c$), 45.8 (C-$3^t$), 43.1 (C-$4^t$), 42.9 (C-$3^c$), 41.0 (C-$4^c$); EI-MS *m*/*z* 298 (25) $[M]^+$, 261 (20), 160 (100); FAB-HRMS calcd for $[C_{17}H_{12}ClFN_2 + H]^+$ 299.0751, found 299.0750.

**5-Methyl-3-phenyl-3,4-dihydro-2*H*-pyrrole-2-carbonitrile (3j).** The title compound was prepared according to the general procedure from aminoacetonitrile hydrochloride (494 mg, 5.34 mmol), benzylideneacetone (854 mg, 5.84 mmol), and pyridine (24 mL). After 4 h, the reaction mixture was worked up to yield a black oil (977 mg). Ratio of isomers: *trans*/*cis* = 3.3:1. Purification of a portion (706 mg) of the crude product by flash chromatography (cyclohexane/ethyl acetate, 10:1 + 1% $EtNMe_2$, alumina) gave *trans*-**3j** as reddish crystals (57 mg, 33%): mp 82−83 °C dec, $R_f$ (cyclohexane/ethyl acetate 2:1) = 0.52 and *cis*-**3j** as reddish oil (28 mg, 16%), $R_f$ (cyclohexane/ethyl acetate 2:1) = 0.35. The *cis*-isomer still contained impurities.

*trans*-Isomer: IR (film) $\nu$ = 2921, 2243, 1714, 1642, 1495, 1456, 1430, 1381, 1318, 1021, 759, 701 $cm^{-1}$; $^1H$ NMR (300 MHz, $CDCl_3$) $\delta$ = 7.41−7.27 (m, 3H, phenyl), 7.24−7.16 (m, 2H, phenyl), 4.69 (dsext, $J_d$ = 6.8 Hz, $J_{sext}$ = 1.6 Hz, 1H, H-2), 3.80 (d-pseudo-t, 1H, $J_d$ = 9.4 Hz, $J_t \approx 7$ Hz, H-3), 3.22 (ddd, $J$ = 17.8, 9.6, 1.6 Hz, 1H, H-4a), 2.82 (ddd, 1H, $J$ = 17.8, 7.4, 1.6 Hz, H-4b), 2.18 (d, 3H, $J$ = 1.6 Hz, $CH_3$); $^{13}C$ NMR (75.5 MHz, $CDCl_3$) $\delta$ = 179.8 (C=N), 140.2 (C-1′), 129.2 (2C, Ph), 127.7, 126.6 (2C, Ph), 119.3 (CN), 68.8 (C-2), 49.1 (C-3), 47.5 (C-4), 19.8 ($CH_3$); EI-MS (*m*/*z*) 184 (32) $[M]^+$, 143 (19), 80 (100); FAB-HRMS calcd for $[C_{12}H_{12}N_2 + H]^+$ 185.1079, found 185.1072.

*cis*-Isomer: IR (NaCl, film) $\nu$ = 2924, 2244, 1708, 1641, 1495, 1455, 1429, 1381, 912, 760, 733, 700 $cm^{-1}$. $^1H$ NMR (300 MHz, $CDCl_3$) $\delta$ = 7.40−7.26 (m, 3H, phenyl), 7.22−7.16 (m, 2H, phenyl), 5.07 (d-pseudosext, 1H, $J_d$ = 8.4, $J_{sext} \approx 1$ Hz, H-2), 3.79 (dt, 1H, $J$ = 8.4 Hz, $J$ = 7.2 Hz, H-3), 3.03 (ddd, $J$ = 17.9, 8.4, 1.5 Hz, 2H, H-4a), 2.95 (ddd, $J$ = 17.9, 7.2, 1.5 Hz, 2H, H-4b), 2.20 (d, 3H, $J$ = 1.2 Hz, $CH_3$); $^{13}C$ NMR (75.5 MHz, $CDCl_3$) $\delta$ = 180.8 (C=N), 138.3 (C-1′), 129.1 (2C, Ph), 127.9, 127.4 (2C, Ph), 116.9 (CN), 67.0 (C-2), 46.4, 45.9 (C-3, C-4), 20.0 ($CH_3$); EI-MS *m*/*z* 184 (27) $[M]^+$, 143 (19), 80 (100); FAB-HRMS calcd for $[C_{12}H_{12}N_2 + H]^+$ 185.1079, found 185.1075.

**3-(4-Chlorophenyl)-5-isopropyl-3,4-dihydro-2*H*-pyrrole-2-carbonitrile (3k).** The title compound was prepared according to the general procedure from aminoacetonitrile hydrochloride (200 mg, 2.16 mmol), (*E*)-1-(4-chlorophenyl)-4-methylpent-1-en-3-one[37] (300 mg, 1.44 mmol), and pyridine (7.1 mL). After 4 h, TLC indicated incomplete conversion, and another portion of aminoacetonitrile hydrochloride (70 mg, 0.76 mmol) was added. After a further 14 h, workup yielded a black oil (452 mg). Ratio of isomers: *trans*/*cis* = 1.2:1. Purification of the crude product by flash chromatography (cyclohexane/ethyl acetate, 10:1) gave *trans*-**3k** as a yellow oil (72 mg, 0.29 mmol, 21%), $R_f$ (cyclohexane/ethyl acetate 2:1) = 0.36, and *cis*-**3k** as brown oil (42 mg, 0.17 mmol, 12%), $R_f$ (cyclohexane/ethyl acetate 2:1) = 0.14. Both products still contained impurities after chromatography.

*trans*-Isomer: $^1H$ NMR (400 MHz, $CDCl_3$) $\delta$ 7.28 (AA′-part of AA′BB′-system, 2H, aryl), 7.10 (BB′-part of a AA′BB′-system, 2H, aryl), 4.62 (d-pseudo-q, $J_d$ = 6.9, $J_q \approx 1.5$ Hz, 1H, H-2), 3.70 (d-pseudo-t, $J_t \approx 7$ Hz, $J_d$ = 9.3 Hz, 1H, H-3), 3.18 (ddd, $J$ = 17.8, 9.4, 1.5 Hz, 1H, H-4a), 2.64−2.76 (m, 2H) this multiplet contains: 2.73 (ddd, $J$ = 17.8, 7.5, 1.7 Hz, H-4b), 2.70 (d-sept, $J_{sept}$ = 7.0 Hz, $J_d$ = 1.4 Hz, 1H, $CH(CH_3)_2$), 1.18 (dd, $J$ = 7.0, 1.0 Hz, 6H, $CH(CH_3)$).

*cis*-Isomer: $^1H$ NMR (400 MHz, $CDCl_3$) $\delta$ 7.29 (AA′-part of a AA′BB′-system, 2H, aryl), 7.09 (BB′-part of a AA′BB′-system, 2H, aryl), 5.03 (d-pseudo-q, $J_d$ = 8.5 Hz, $J_q \approx 1$ Hz, 1H, H-2), 3.71 (dt, $J_t$ = 8.5 Hz, $J_d$ = 6.4 Hz, 1H, H-3), 3.01 (ddd, $J$ = 17.5, 8.5, 1.2 Hz, 1H, H-4a), 2.86 (ddd, $J$ = 17.5, 6.4, 1.3 Hz, 1H H-4b), 2.73 (d-sept, $J_{sept}$ = 7.0 Hz, $J_d$ = 0.9 Hz, 1H), 1.20 (d, $J$ = 7.0 Hz, 6H $CH(CH_3)$).

**General Procedure for the Synthesis of Pyrroles (15a−m). Synthesis of Precursors (12 or 14).** α-Aminonitrile **11** (1.2 mmol) and the α,β unsaturated carbonyl compound **1** (1.44 mmol, 1.2 equiv) were dissolved in dry dichloromethane (2.5 mL each) under argon atmosphere. In case of the hydrochlorides, the

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obtained suspension turned clear after addition of triethylamine (232 μL). Dry dichloromethane (5 mL) was cooled to 0 °C in a dried flask equipped with a septum under argon atmosphere. Successively, $TiCl_4$ (1 mol/L in dichloromethane, 1.2 mmol, 1 equiv) and triethylamine (732 μL, 5.282 mmol, 4.4 equiv) were added. The amount of triethylamine was reduced to 500 μL when α-aminonitrile hydrochlorides were used. Both dissolved starting materials were added to the brown $TiCl_4$/triethylamine solution simultaneously within 1 min using syringes. Stirring was continued at 0 °C. Depending on the conversion (TLC monitoring), the reaction mixture was worked up directly or was warmed to room temperature. Water was added and a slimy precipitate appeared. After being stirred for 10−20 min at room temperature, the reaction mixture was extracted with dichloromethane (4 × 15 mL). The combined organic layers were washed with satd aq $NaHCO_3$ (20 mL), water (20 mL), and brine (20 mL). After drying over $Na_2SO_4$, the solvent was removed in vacuo and the crude product was converted to pyrrole **6** or was purified by flash chromatography.

**Dehydrocyanation.** The precursor (**12** or **14**) was dissolved in DMF (100 μL for 10 mg of **12** or **14**), and potassium *tert*-butoxide (1.1 equiv) was added. The intensely colored mixture was heated to 100 °C in an argon-filled closed vial by irradiation with microwaves for 3 min (CEM Discover, air cooling, IR temperature control, maximum power 150 W). After pressure equilibration, satd aq $NaHCO_3$ (5−10 mL) was added, and the mixture was extracted with ethyl acetate (4 × 5−10 mL). The combined organic layers were washed with water and brine (10−20 mL each) and dried over $Na_2SO_4$, and the solvent was removed in vacuo. The crude product was purified by flash chromatography.

**2,3,5-Triphenyl-3,4-dihydro-2*H*-pyrrole-2-carbonitrile (14a).** The title compound was prepared according to the general procedure from chalcone (250.3 mg, 1.20 mmol), amino(phenyl)-acetonitrile hydrochloride (**11a**·HCl,[28] 190.3 mg, 1.13 mmol), 1 N $TiCl_4$ solution in dichloromethane (1.20 mL, 1.20 mmol), and triethylamine (732 μL, 5.28 mmol). The reaction mixture was stirred for 1 h at 0 °C and for 1 h at room temperature. Although TLC indicated incomplete conversion, the dark brown reaction mixture was worked up. A portion (335.7 mg) of the crude product (356.7 mg) was purified by flash chromatography (petroleum ether/ethyl acetate 8:1) to yield **14a** (159.6 mg, 0.496 mmol, 47%) as a diastereomeric mixture (1.45:1). The relative configuration could not be assigned: brown resin; $R_f$ 0.38 (petroleum ether/ethyl acetate 5:1); IR (ATR) $\nu$ = 2240 (vw, CN), 1605, 1573, 1494, 1448, 1343, 1025, 758, 732, 690 $cm^{-1}$; major diastereomer $^1H$ NMR, COSY, HMBC (400 MHz, $CDCl_3$) $\delta$ = 8.10−8.07 (m, 2H, H2′,6′), 7.62−7.49 (m, 3H, H3′,5′, H4′), 7.17−7.04 (m, 6H, H3″,5″, H4″, H3‴,5‴, H4‴), 7.00−6.94 (m, 2H, H2″,6″), 6.84−6.79 (m, 2H, H2‴,6‴), 4.38 (t, $J$ = 8.4 Hz, 1H, H3), 3.67−3.59 (m, 1H, $H_a$4), 3.39 (dd, $J$ = 17.1, 8.4 Hz, 1H, $H_b$4); $^{13}C$ NMR, HSQC, HMBC (100.6 MHz, 400 MHz, $CDCl_3$) $\delta$ = 178.4 (C5), 136.3 (C1‴), 134.3 (C1″), 132.9 (C1′), 132.5 (C4′), 129.1 (2C, C3′,5′), 128.7 (2C, C2′,6′), 128.5 (C4″), 128.4 (2C, C2‴,6‴), 128.4 (2C, C3″,5″/C3‴,5‴), 128.3 (2C, C3″,5″/C3‴,5‴), 127.8 (C4‴), 126.7 (2C, C2″,6″), 121.8 (CN), 79.7 (C2), 56.2 (C3), 41.0 (C4). Characteristic chemical shifts of minor diastereomer: $^1H$ NMR, COSY, HMBC (400 MHz, $CDCl_3$) $\delta$ = 8.06−8.03 (m, 2H, H2′,6′), 3.72 (dd, $J$ = 10.1, 7.9 Hz, H3), 3.67−3.59 (m, 2H, H4); $^{13}C$ NMR, HSQC, HMBC (100.6 MHz, 400 MHz, $CDCl_3$) $\delta$ = 178.4 (C5), 139.4 (C1‴), 136.2 (C1″), 133.2 (C1′), 132.4 (C4′), 129.0 (2C), 129.0 (2C), 128.9 (2C), 128.8, 128.6 (2C), 128.6 (2C), 128.5, 125.9 (2C), 118.3 (CN), 81.9 (C2), 58.9 (C3), 42.0 (C4); EI-MS ($m/z$) = 322 (31) $[M]^+$, 218 (100), 115 (41); FAB-HRMS calcd for $[C_{23}H_{18}N_2 + H]^+$ 323.1548, found 323.1546.

**2,3,5-Triphenyl-1*H*-pyrrole (15a)[38].** The title compound was prepared according to the general method from chalcone (150.8 mg, 0.724 mmol) and amino(phenyl)acetonitrile hydrochloride (**11a**·HCl,[28] 148.8 mg, 0.882 mmol), 1 N $TiCl_4$ in dichloromethane (0.72 mL, 0.72 mmol), and triethylamine (439 μL, 3.169 mmol, 4.4 equiv). The reaction mixture was stirred for 30 min at 0 °C and for 3.5 h at room temperature. The crude intermediate (228.8 mg) was converted to pyrrole **15a** without further purification. A portion (98.5 mg, 0.306 mmol) of crude **14a** was reacted with KO-*t*-Bu (37.7 mg, 0.336 mmol) in DMF (0.99 mL) according to the general procedure. A portion (83.4 mg) of the crude pyrrole (92.9 mg) was purified by column chromatography (petroleum ether/ ethyl acetate 8:1) to yield **6a** (34.5 mg, 0.117 mmol, 41% overall) as a slightly yellow solid: mp 134−136 °C (lit.[38] mp 135−137 °C); $R_f$ 0.42 (petroleum ether/ ethyl acetate 8:1); IR (ATR) $\nu$ = 3425, 3058, 1603, 1486, 1451, 1261, 1071, 955, 757, 695, 586, 593, 506 $cm^{-1}$; $^1H$ NMR (400 MHz, DMSO-$d_6$) $\delta$ = 11.4 (bs, 1H, NH), 7.79 (AA′ part of AA′BB′C system, 2H), 7.42−7.31 (m, 6H), 7.30−7.26 (m, 4H), 7.25−7.15 (m, 3H), 6.76 (d, $J$ = 2.7 Hz, 1H, H4); $^{13}C$ NMR, PENDANT (100.6 MHz, DMSO-$d_6$) $\delta$ = 136.5 (Cq), 132.8 (Cq), 132.2 (Cq), 131.9 (Cq), 129.3 (Cq), 128.5 (2C), 128.2 (4C), 128.0 (2C), 127.8 (2C), 126.6, 125.8, 125.5, 123.8 (2C), 122.6 (Cq), 107.9 (C4); EI-MS ($m/z$) = 295 (100) $[M]^+$; ESI-HRMS calcd for $[C_{22}H_{17}N]^+$ 295.1361, found 295.1353.

**5-(4-Fluorophenyl)-3-(4-methoxyphenyl)-2-phenyl-1*H*-pyrrole (15b).** The title compound was prepared according to the general method from 4-methoxy-4′-fluorochalcone (307.8 mg, 1.20 mmol), amino(phenyl)acetonitrile (**11a**, 190.6 mg, 1.44 mmol, 1.2 equiv), 1 N $TiCl_4$ solution in dichloromethane (1.2 mL, 1.2 mmol), and triethylamine (732 μL, 5.28 mmol, 4.4 equiv). The reaction mixture was stirred for 140 min at 0 °C and for 3.5 h at room temperature. Workup yielded a brown resin (424.9 mg, 96%) which was converted to **15b** without further purification. A portion of the crude precursor (68.5 mg, 0.185 mmol) was reacted with KO-*t*-Bu (22.8 mg, 0.203 mmol) in DMF (0.69 mL). A portion (50.5 mg) of the crude pyrrole (63.5 mg) was purified by column chromatography (cyclohexane/ethyl acetate 10:1) to yield **15b** (26.5 mg, 0.077 mmol, 53%, 50% overall) as a yellow resin: $R_f$ 0.38 (cyclohexane/ ethyl acetate 5:1); IR (ATR) $\nu$ = 1511 (m), 1493, 1242, 1173, 833, 799, 764, 696, 519, 507 $cm^{-1}$; $^1H$ NMR (400 MHz, DMSO-$d_6$) $\delta$ = 11.29 (bs, 1H, NH), 7.81 (mc, 2H, H2′,6′), 7.41−7.37 (m, 2H), 7.33 (pseudo-t, $J_{app} \approx$ 7.6 Hz, 2H), 7.26−7.17 (m, 5H), 6.85 (BB′ part of AA′BB′system, 2H, H3″,5″), 6.66 (d, $J$ = 2.7 Hz, 1H, H4), 3.74 (s, 3H, $OCH_3$); $^{13}C$ NMR, PENDANT (125.8 MHz, DMSO-$d_6$) $\delta$ = 160.6 (d, $^1J_{C,F}$ = 242.8 Hz, 1C, C4′), 157.4 (C4″), 133.0 (Cq), 130.9 (Cq), 129.1 (Cq), 129.0 (2C), 128.9 (Cq), 128.7 (Cq), 128.3 (2C), 127.9 (2C), 126.4 (C4‴), 125.7 (d, $^3J_{C,F}$ = 8.2 Hz, 2C, C2′,6′), 122.4 (Cq), 115.4 (d, $^2J_{C,F}$ = 22.0 Hz, 2C, C3′,5′), 113.8 (2C), 108.0 (C4), 55.0 ($OCH_3$); EI-MS ($m/z$) = 343 (100) $[M]^+$, 328 (30), 298 (10), 84 (69), 69 (26), 56 (92), 41 (59); FAB-HRMS calcd for $[C_{23}H_{18}FNO]^+$ 343.1372, found 343.1360.

**3-(2-Chlorophenyl)-5-(4-fluorophenyl)-2-phenyl-1*H*-pyrrole (15c).** The title compound was prepared according to the general method from 2-chloro-4′-fluorochalcone (312.8 mg, 1.20 mmol), amino(phenyl)acetonitrile hydrochloride (**11a**·HCl,[28] 242.8 mg, 1.44 mmol, 1.2 equiv), 1 N $TiCl_4$ solution in dichloromethane (1.2 mL, 1.2 mmol), and triethylamine (732 μL, 5.28 mmol, 4.4 equiv). The reaction mixture was stirred 80 min at 0 °C. The crude intermediate (brown resin, 464.1 mg) was converted to **15c** without further purification. A portion of the crude intermediate (112.9 mg, 0.301 mmol) was reacted according to the general procedure with KO-*t*-Bu (37.2 mg, 0.331 mmol) in DMF (1.13 mL). A portion (105.0 mg) of the crude pyrrole (111.2 mg) was purified by column

(38) Fürstner, A.; Weintritt, H.; Hupperts, A. *J. Org. Chem.* **1995**, *60*, 6637–6641.

chromatography (toluene) to yield **15c** (44.6 mg, 0.128 mmol, 45%, 45% overall) as a slightly pink resin: $R_f$ 0.70 (toluene), 0.48 (cyclohexane/ ethyl acetate 5:1); IR (ATR) $\nu$ = 3414, 1489, 1226, 1158, 830, 793, 758, 729, 695, 544 $cm^{-1}$; $^1H$ NMR (500 MHz, DMSO-$d_6$) $\delta$ = 11.41 (bs, 1H, NH), 7.83 (mc, 2H, H2″,6″), 7.49 (mc, 1H), 7.33−7.15 (m, 10H), 6.62 (d, $J$ = 2.7 Hz, 1H, C4); $^{13}C$ NMR, PENDANT (100.6 MHz, DMSO-$d_6$) $\delta$ = 160.6 (d, $^1J_{C,F}$ = 243.6 Hz, 1C, C4″), 135.8 (Cq), 132.9 (Cq), 132.5 (Cq), 132.4, 130.7 (Cq), 130.1 (Cq), 129.5, 128.8 (d, $^4J_{C,F}$ = 2.9 Hz, 1C, C1″), 128.3, 128.1 (2C), 127.0, 126.4 (2C), 126.1, 125.8 (d, $^3J_{C,F}$ = 8.1 Hz, 2C, C2″,6″), 120.1 (Cq), 115.3 (d, $^2J_{C,F}$ = 21.3 Hz, 2C, C3″,5″), 109.3 (C4); EI-MS ($m/z$) = 347 (100) $[M]^+$, 312 (34), 189 (12), 156 (22), 103 (20), 84 (37), 69 (14), 56 (53), 40 (46); FAB-HRMS calcd for $[C_{22}H_{15}ClFN]^+$ 347.0877, found 347.0880.

**2-(4-Fluorophenyl)-3,5-diphenyl-1*H*-pyrrole (15d)[39].** The title compound was prepared according to the general method from chalcone (250.4 mg, 1.20 mmol), amino(4-fluorophenyl)-acetonitrile **11b** (216.9 mg, 1.45 mmol, 1.2 equiv), 1 N $TiCl_4$ solution in dichloromethane (1.2 mL, 1.2 mmol), and triethylamine (732 $\mu$L, 5.28 mmol, 4.4 equiv). The reaction mixture was stirred for 120 min at 0 °C. The crude brown resin (388.4 mg, 95%) was reacted to **15d** without further purification. A portion of the crude intermediate (119.2 mg, 0.350 mmol) was reacted according to the general procedure with KO-*t*-Bu (43.2 mg, 0.385 mmol) in DMF (1.2 mL). A portion (170.7 mg) of the crude pyrrole (190.8 mg) was purified by column chromatography (petroleum ether/ethyl acetate 8:1) to yield **15d** (45.2 mg, 0.144 mmol, 46%, 44% overall) as a slightly yellow foam: $R_f$ 0.68 (petroleum ether/ ethyl acetate 5:1); IR (ATR) $\nu$ = 1691, 1508, 1488, 1220, 838, 812, 752, 691, 541, 518, 499 $cm^{-1}$; $^1H$ NMR (400 MHz, DMSO-$d_6$) $\delta$ = 11.40 (bs, 1H, NH), 7.78 (pseudo-d, $J_{app}$ ≈ 7.8 Hz, 2H), 7.44−7.35 (m, 4H), 7.29−7.26 (m, 4H), 7.20 (pseudo-t, $J_{app}$ ≈ 8.6 Hz, 4H), 6.75 (d, $J$ = 2.6 Hz, 1H, H4); $^{13}C$ NMR, PENDANT, HMBC (100.6 MHz, DMSO-$d_6$) $\delta$ = 161.0 (d, $^1J_{C,F}$ = 244.0 Hz, 1C, C4′), 136.3 (Cq), 132.2 (Cq), 131.8 (Cq), 129.9 (d, $^3J_{C,F}$ = 8.1 Hz, 2C, C2′,6′), 129.2 (d, $^4J_{C,F}$ = 2.9 Hz, 1C, C1′), 128.5 (3C, contains C2), 128.2 (2C), 127.8 (2C), 125.8, 125.5, 123.8 (2C), 122.5 (Cq), 115.1 (d, $^2J_{C,F}$ = 21.3 Hz, 2C, C3′,5′), 107.8 (C4); EI-MS ($m/z$) = 313 (100) $[M]^+$; FAB-HRMS calcd for $[C_{22}H_{16}FN]^+$ 313.1267, found 313.1272.

**2-Cyclohexyl-3,5-diphenyl-1*H*-pyrrole (15e).** The title compound was prepared according to the general method from chalcone (249.4 mg, 1.20 mmol), amino(cyclohexyl)acetonitrile (**11c**, 199.1 mg, 1.44 mmol, 1.2 equiv), 1 N $TiCl_4$ solution in dichloromethane (1.2 mL, 1.2 mmol), and triethylamine (732 $\mu$L, 5.28 mmol, 4.4 equiv). The reaction mixture was stirred for 165 min at 0 °C. The crude material (reddish brown resin, 399.2 mg) was reacted to **15e** without further purification. A portion of crude intermediate (150.9 mg, 0.459 mmol) was reacted according to the general procedure with KO-*t*-Bu (56.7 mg, 0.505 mmol) in DMF (1.5 mL). A portion (145.3 mg) of the crude pyrrole (151.0 mg) was purified by column chromatography (petroleum ether/ethyl acetate 8:1) to yield **15e** (51.2 mg, mmol, 0.170 mmol, 38%, 38% overall) as a slightly yellow resin: $R_f$ 0.60 (petroleum ether/ ethyl acetate 5:1); IR (ATR) $\nu$ = 2927, 2917, 2848, 1603, 1493, 1447, 978, 755, 695, 665, 514, 502 $cm^{-1}$; $^1H$ NMR (400 MHz, DMSO-$d_6$) $\delta$ = 10.77 (bs, 1H, NH), 7.69 (pseudo-d, $J_{app}$ ≈ 7.4 Hz, 2H, Ph), 7.40−7.30 (m, 6H, Ph), 7.20 (pseudo-t, $J_{app}$ ≈ 7.1 Hz, 1H, Ph-H4), 7.14 (pseudo-t, $J_{app}$ ≈ 7.3 Hz, 1H, Ph-H4), 6.53 (d, $J$ = 2.7 Hz, 1H, H4), 2.80 (mc, 1H, cyclohexyl-H1), 1.77 (mc, 7H, cyclohexyl), 1.29 (bs, 3H, cyclohexyl); $^{13}C$ NMR, PENDANT (100.6 MHz, DMSO-$d_6$) $\delta$ = 137.1 (Cq), 135.6 (Cq), 132.7 (Cq), 129.7 (Cq), 128.3 (2C), 128.2 (2C), 127.6 (2C), 125.1 (Ph-C4), 124.9 (Ph-C4), 123.4 (2C), 120.6 (Cq), 105.6 (C4), 35.3 (cyclohexyl-C1), 32.5 (2C, cyclohexyl-C2,6), 26.3 (2C, cyclohexyl-C3,5), 25.4 (cyclohexyl-C4); EI-MS ($m/z$) = 301 (64) $[M]^+$, 258 (49), 244 (15), 232 (13), 83 (20), 70 (15), 55 (50), 43 (100); FAB-HRMS calcd for $[C_{22}H_{23}N]^+$ 301.1831, found 301.1828.

**5-(4-Chlorophenyl)-2-cyclohexyl-3-(3-nitrophenyl)-1*H*-pyrrole (15f).** The title compound was prepared according to the general method from (*E*)-4′-chloro-3-nitrochalcone (496.2 mg, 1.73 mmol), amino(cyclohexyl)acetonitrile (**11c**, 286.0 mg, 2.07 mmol, 1.2 equiv), 1 N $TiCl_4$ solution in dichloromethane (1.74 mL, 1.74 mmol), and triethylamine (1.06 mL, 7.65 mmol). The reaction mixture was stirred for 2.5 h at 0 °C. A portion (626.0 mg) of the crude intermediate (brown resin, 636.3 mg) was filtered through a pad of silica with petroleum ether/ethyl acetate 9:1 to yield a yellow waxy substance (500.2 mg, 1.23 mmol, 72%). A portion of purified intermediate (102.5 mg, 0.251 mmol) was reacted according to the general procedure with KO-*t*-Bu (31.0 mg, 0.276 mmol) in DMF (1.03 mL). A portion (92.9 mg) of the crude pyrrole (98.2 mg) was purified by column chromatography (toluene) to yield **15f** (42.3 mg, 0.111 mmol, 47%, 34% overall) as a yellow solid: mp 227−229 °C; $R_f$ 0.75 (toluene); IR (ATR) $\nu$ = 3394, 2922, 1530, 1515, 1347, 1087, 802, 741, 722, 588, 502 $cm^{-1}$; $^1H$ NMR (500 MHz, DMSO-$d_6$) $\delta$ = 11.00 (bs, 1H, NH), 8.11 (bs, 1H, 3-$NO_2$-$C_6H_4$-H2), 8.06 (d, $J$ = 8.0 Hz, 1H, H4″), 7.80−7.74 (m, 3H, H6″, H2′,6′), 7.68 (t, $J$ = 8.0 Hz, 1H, H5″), 7.42 (XX′ part of AA′XX′ system, $J_{app}$ ≈ 8.5 Hz, 2H, H3′,5′), 6.76 (d, $J$ = 2.5 Hz, 1H, H4), 2.80 (mc, 1H, cyclohexyl-H1), 1.80 (mc, 6H, cyclohexyl), 1.72 (mc, 1H, cyclohexyl), 1.31 (mc, 3H, cyclohexyl); $^{13}C$ NMR, PENDANT (100.6 MHz, DMSO-$d_6$) $\delta$ = 148.0 (C3″), 138.5 (Cq), 137.1 (Cq), 133.8, 131.2 (Cq), 129.8, 129.7 (Cq), 129.3 (Cq), 128.4 (2C), 125.2 (2C), 121.4, 119.7, 118.6, 106.2 (C4), 35.4 (cyclohexyl-C1), 32.3 (2C, cyclohexyl-C2,6), 26.2 (2C, cyclohexyl-C3,5), 25.3 (cyclohexyl-C4); EI-MS ($m/z$) = 380 (100) $[M]^+$, 350 (13), 337 (58), 331 (15), 290 (14), 40 (21); FAB-HRMS calcd for $[C_{22}H_{21}ClN_2O_2]^+$ 380.1292, found 380.1302.

**3,5-Diphenyl-2-methyl-1*H*-pyrrole (15g)[40].** A portion (90.0 mg, 0.346 mmol) of crude imine **12g** was reacted with KO-*t*-Bu (42.7 mg, 0.381 mmol) in DMF (0.9 mL) according to the general procedure. A portion (61.9 mg) of the crude pyrrole (77.6 mg) was purified by column chromatography (toluene) to yield pure **15g** (29.6 mg, 0.127 mmol, 46%, 43% overall) as a slightly yellow resin: $R_f$ 0.50 (toluene); IR (ATR) $\nu$ = 3418, 3053, 1604, 1523, 1494, 1448, 1352, 1152, 804, 754, 691, 647, 523 $cm^{-1}$; $^1H$ NMR (500 MHz, DMSO-$d_6$) $\delta$ = 11.13 (bs, 1H, NH), 7.63 (pseudo-d, $J_{app}$ ≈ 8.2 Hz, 2H, Ph), 7.46−7.42 (m, 2H, Ph), 7.35 (mc, 4H, Ph), 7.19−7.11 (m, 2H, Ph), 6.70 (d, $J$ = 2.6 Hz, 1H, H4), 2.41 (s, 3H, $CH_3$); $^{13}C$ NMR (100.6 MHz, DMSO-$d_6$) $\delta$ = 136.8 (Cq), 132.6 (Cq), 129.2 (Cq), 128.5 (2C), 128.3 (2C), 126.6 (2C), 125.8 (Cq), 125.1, 124.7, 123.0 (2C), 121.2 (Cq), 105.3 (C4), 12.6 ($CH_3$); EI-MS ($m/z$) = 233 (100) $[M]^+$, 40 (35); FAB-HRMS calcd for $[C_{17}H_{15}N]^+$ 233.1205, found 233.1193.

**5-(4-Chlorophenyl)-2-methyl-3-(3-nitrophenyl)-1*H*-pyrrole (15h).** The title compound was prepared according to the general method from (*E*)-4′-chloro-3-nitrochalcone (345.9 mg, 1.20 mmol), 2-aminopropanenitrile hydrochloride (**11d**·HCl,[28] 154.3 mg, 1.45 mmol, 1.2 equiv), 1 N $TiCl_4$ solution in dichloromethane (1.2 mL, 1.2 mmol), and triethylamine (732 $\mu$L, 5.28 mmol, 4.4 equiv). The reaction mixture was stirred for 85 min at 0 °C and for 85 min at room temperature. The crude brown resin (415.9 mg) was reacted to **15h** without further purification. A

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portion of the crude precursor (125.2 mg, 0.368 mmol) was reacted according to the general procedure with KO-*t*-Bu (45.5 mg, 0.405 mmol) in DMF (1.25 mL). A portion (115.0 mg) of the crude pyrrole (150.8 mg) was purified by column chromatography (cyclohexane/ ethyl acetate 10:1 to 8:1) to yield **15h** (35.1 mg, 0.112 mmol, 40%, 40% overall) as an orange solid: mp 179−182 °C; $R_f$ 0.34 (cyclohexane/ethyl acetate 3:1); IR (ATR) $\nu$ = 1526, 1509, 1488, 1341, 824, 782, 736, 721, 672, 499 cm$^{-1}$; $^1$H NMR (500 MHz, DMSO-$d_6$) $\delta$ = 11.41 (bs, 1H, NH), 8.22 (s, 1H, H2″), 8.01 (dd, $J$ = 8.1, 1.5 Hz, 1H, H4″), 7.91 (d, $J$ = 7.8 Hz, 1H, H6″), 7.70 (AA′ part of AA′BB′ system, 2H, H2′,6′), 7.66 (t, $J$ = 7.8 Hz, 1H, H5″), 7.42 (BB′ part of AA′BB′ system, 2H, H3′,5′), 6.95 (d, $J$ = 2.7 Hz, 1H, H4), 2.47 (s, 3H, $CH_3$); $^{13}$C NMR, PENDANT (100.6 MHz, DMSO-$d_6$) $\delta$ = 148.2 (Cq, Ar-C3″), 138.4 (Cq, Ar-C1″), 132.7 (Ar-C6″), 131.2 (Cq), 129.9 (Ar-C5″), 129.7 (Cq), 128.7 (Cq), 128.6 (2C, Ar-C2′,6′), 127.8 (Cq), 124.8 (2C, Ar-C3′,5′), 120.2 (Ar-C4″), 119.3 (Ar-C2″), 119.2 (C3), 106.0 (C4), 12.7 ($CH_3$); EI-MS ($m/z$) = 312 (100) [M]$^+$, 282 (11), 266 (21), 251 (11); FAB-HRMS calcd for $[C_{17}H_{13}ClN_2O_2]^+$ 312.0666, found 312.0656.

**5-(4-Fluorophenyl)-3-(4-methoxyphenyl)-2-methyl-1*H*-pyrrole (15i).** The title compound was prepared according to the general method from 4-methoxy-4′-fluorochalcone (307.5 mg, 1.20 mmol), 2-aminopropanenitrile hydrochloride (**11d**·HCl,[28] 153.4 mg, 1.44 mmol, 1.2 equiv), 1 N $TiCl_4$ solution in dichloromethane (1.2 mL, 1.2 mmol), and triethylamine (732 $\mu$L, 5.28 mmol, 4.4 equiv). The reaction mixture was stirred for 3.5 h at 0 °C. The crude intermediate (brown foam, 354.5 mg) was reacted to **15i** without further purification. A portion of the crude precursor (126.5 mg, 0.410 mmol) was reacted according to the general procedure with KO-*t*-Bu (50.6 mg, 0.451 mmol) in DMF (1.27 mL). A portion (89.1 mg) of the crude pyrrole (105.8 mg) was purified by column chromatography (cyclohexane/ ethyl acetate 10:1 to 8:1) to yield **15i** (40.3 mg, 0.143 mmol, 42%, 40% overall) as a yellow resin which crystallized at −18 °C: mp 106−109 °C dec; $R_f$ = 0.36 (cyclohexane/ethyl acetate 5:1); IR (ATR) $\nu$ = 1506, 1223, 1175, 1152, 1024, 831, 811, 793, 604, 533, 522 cm$^{-1}$; $^1$H NMR (500 MHz, DMSO-$d_6$) $\delta$ = 11.03 (bs, 1H, NH), 7.64 (mc, 2H, H2′,6′), 7.33 (AA′ part of AA′BB′ system, 2H, H2″,6″), 7.18 (pseudo-t, $J_{app} \approx$ 8.9 Hz, 2H, H3′,5′), 6.93 (BB′ part of AA′BB′ system, 2H, H3″,5″), 6.58 (d, $J$ = 2.8 Hz, 1H, H4), 3.76 (s, 3H, $OCH_3$), 2.36 (s, 3H, $CH_3$); $^{13}$C NMR, PENDANT (100.6 MHz, DMSO-$d_6$) $\delta$ = 160.1 (d, $^1J_{C,F}$ = 241.6 Hz, 1C, C4′), 156.8 (C4″), 129.5 (d, $^4J_{C,F}$ = 3.1 Hz, 1C, C1′), 129.3 (Cq), 128.1 (Cq), 127.7 (2C, C2″,6″), 124.9 (Cq), 124.7 (d, $^3J_{C,F}$ = 7.6 Hz, 2C, C2′,6′), 121.0 (C3), 115.4 (d, $^2J_{C,F}$ = 21.3 Hz, 2C, C3′,5′), 113.8 (2C, Ar−C3″,5″), 105.2 (C4), 55.0 ($OCH_3$), 12.4 ($CH_3$); EI-MS ($m/z$) 281 (100) [M]$^+$, 266 (43), 55 (20), 41 (13); FAB-HRMS calcd for $[C_{18}H_{16}FNO]^+$ 281.1216, found 281.1222.

**3-(2-Chlorophenyl)-5-(4-fluorophenyl)-2-methyl-1*H*-pyrrole (15j).** The title compound was prepared according to the general method from 2-chloro-4′-fluorochalcone (313.4 mg, 1.20 mmol), 2-aminopropanenitrile hydrochloride (**11d**·HCl,[28] 154.9 mg, 1.45 mmol, 1.2 equiv), 1 N $TiCl_4$ solution in dichloromethane (1.2 mL, 1.2 mmol), and triethylamine (732 $\mu$L, 5.28 mmol, 4.4 equiv). The reaction mixture was stirred for 135 min at 0 °C and for 60 min at room temperature. The crude intermediate (reddish resin, 355.2 mg) was reacted to **15j** without further purification. A portion of the crude precursor (125.7 mg, 0.402 mmol) was reacted with KO-*t*-Bu (49.6 mg, 0.442 mmol) in DMF (1.25 mL) according to the general procedure. A portion (139.5 mg) of the crude pyrrole (161.8 mg) was purified by column chromatography (cyclohexane/ethyl acetate 15:1) to yield **15j** (30.9 mg, 0.108 mmol, 31%, 30% overall) as a yellow resin: $R_f$ 0.26 (cyclohexane/ethyl acetate 10:1); IR (ATR) $\nu$ = 1527, 1491, 1226, 1155, 832, 808, 757, 744, 590, 524 cm$^{-1}$; $^1$H NMR (400 MHz, DMSO-$d_6$) $\delta$ = 11.20 (bs, 1H, NH), 7.64 (mc, 2H, Ar−H2″,6″), 7.46 (d, $J$ = 7.5 Hz, 1H, H6′), 7.36−7.32 (m, 2H, Ar), 7.30−7.25 (m, 1H, Ar), 7.18 (pseudo-t, $J_{app} \approx$ 8.9 Hz, 2H, H3″,5″), 6.51 (d, $J$ = 2.8 Hz, 1H, H4), 2.18 (s, 3H, $CH_3$); $^{13}$C NMR, PENDANT (125.8 MHz, DMSO-$d_6$) $\delta$ = 160.2 (d, $^1J_{C,F}$ = 241.9 Hz, 1C, C4″), 135.4 (C1′), 132.4 (C2′), 132.0, 129.6, 129.4 (d, $^4J_{C,F}$ = 2.9 Hz, 1C, C1″), 128.1 (Cq), 127.6, 126.9 (Cq), 126.9, 124.8 (d, $^3J_{C,F}$ = 7.9 Hz, 2C, C2″,6″), 119.1 (C3), 115.5 (d, $^2J_{C,F}$ = 21.3 Hz, 2C, C3″,5″), 107.1 (C4), 55.0 ($OCH_3$), 12.0 ($CH_3$); EI-MS ($m/z$) = 285 (100) [M]$^+$, 249 (19), 69 (61), 55 (29), 41 (23); FAB-HRMS calcd for $[C_{17}H_{13}ClFN]^+$ 285.0721, found 285.0714.

**3-Methyl-2,5-diphenyl-1*H*-pyrrole (15k)**[21]**.** The title compound was prepared according to the general method from (*E*)-1-phenylbut-2-en-1-one[41] (175.4 mg, 1.20 mmol), amino(phenyl)acetonitrile hydrochloride (**11a**·HCl,[28] 242.8 mg, 1.44 mmol, 1.2 equiv), 1 N $TiCl_4$ solution in dichloromethane (1.2 mL, 1.2 mmol), and triethylamine (732 $\mu$L, 5.28 mmol, 4.4 equiv). The reaction mixture was stirred for 120 min at 0 °C. The crude intermediate (brown resin, 308.4 mg) was reacted to **15k** without further purification. A portion of the crude precursor (124.9 mg, 0.480 mmol) was reacted with KO-*t*-Bu (59.2 mg, 0.528 mmol) in DMF (1.25 mL) according to the general procedure. A portion (137.1 mg) of the crude pyrrole (155.5 mg) was purified by column chromatography (toluene) to yield **15k** (30.4 mg, 0.130 mmol, 31%, 31% overall) as a slightly yellow solid: mp 100−101 °C (lit.[21] mp 100−101 °C); $R_f$ 0.62 (toluene); IR (ATR) $\nu$ = 3451, 1602, 1491, 1467, 1439, 1263, 807, 755, 702, 692, 660, 506, 494 cm$^{-1}$; $^1$H NMR (400 MHz, DMSO-$d_6$) $\delta$ = 11.00 (bs, 1H, NH), 7.73−7.70 (m, 2H, Ph), 7.58−7.55 (m, 2H, Ph), 7.45−7.40 (m, 2H, Ph), 7.37−7.32 (m, 2H, Ph), 7.26−7.21 (m, 1H, Ph), 7.17−7.13 (m, 1H, Ph), 6.46 (d, $J$ = 2.6 Hz, 1H, H4), 2.21 (s, 3H, $CH_3$); $^{13}$C NMR, PENDANT (100.6 MHz, DMSO-$d_6$) $\delta$ = 133.2 (Cq), 132.5 (Cq), 131.0 (Cq), 129.2 (Cq), 128.5 (2C), 128.3 (2C), 126.5 (2C), 125.5, 125.4, 123.7 (2C), 116.8 (Cq), 109.7 (C4), 12.8 ($CH_3$); FAB-MS ($m/z$) 234.2 (42) [M + H]$^+$, 233.2 (100) [M]$^+$; FAB-HRMS calcd for $[C_{17}H_{15}N]^+$ 233.1205, found 233.1204.

**2,3-Diphenyl-1*H*-pyrrole (15l)**[12,31]**.** The title compound was prepared according to the general method from cinnamaldehyde (151 $\mu$L, 158.6 mg, 1.20 mmol), amino(phenyl)acetonitrile hydrochloride (**11a**·HCl,[28] 242.9 mg, 1.44 mmol, 1.2 equiv), 1 N $TiCl_4$ solution in dichloromethane (1.2 mL, 1.2 mmol), and triethylamine (732 $\mu$L, 5.28 mmol, 4.4 equiv). The reaction mixture was stirred for 120 min at −50 °C. The crude intermediate (slightly brown resin, 323.0 mg) was reacted to **15l** without further purification. A portion of the crude precursor (133.4 mg, 0.542 mmol) was reacted with KO-*t*-Bu (66.9 mg, 0.596 mmol) in DMF (1.33 mL) according to the general procedure. A portion (126.0 mg) of the crude pyrrole (153.4 mg) was purified by column chromatography (cyclohexane/ ethyl acetate 10:1) to yield **15l** (20.0 mg, 0.091 mmol, 21%, 21% overall) as a slightly brown solid: mp 125−126 °C dec (lit.[31] mp 127 °C); $R_f$ 0.43 (cyclohexane/ ethyl acetate 5:1); IR (ATR) $\nu$ = 3331, 1504, 1492, 1101, 893, 772, 757, 740, 687, 669, 605, 580, 551 cm$^{-1}$; $^1$H NMR (400 MHz, DMSO-$d_6$) $\delta$ = 11.19 (bs, 1H, NH), 7.32−7.28 (m, 4H, Ph), 7.26−7.23 (m, 4H, Ph), 7.23−7.18 (m, 1H, Ph), 7.17−7.12 (m, 1H, Ph), 6.88 (t, $J$ = 2.6 Hz, 1H, H5), 6.25 (t, $J$ = 2.6 Hz, 1H, H4); $^{13}$C NMR, PENDANT (100.6 MHz, DMSO-$d_6$) $\delta$ = 137.1 (C1″), 133.3 (C1′), 128.3 (2C), 128.2 (2C), 127.9 (2C), 127.3 (Cq), 127.3 (2C), 126.2, 125.3 (C4′, C4″), 121.0 (Cq), 118.6 (C5), 110.0 (C4); EI-MS ($m/z$) 219 (100) [M]$^+$, 129 (22), 117 (68), 103 (51), 90 (36), 83 (18), 77 (30), 55 (43), 40 (28); FAB-HRMS calcd for $[C_{16}H_{13}N]^+$ 219.1048, found 219.1058.

**2,3-Diphenyl-4,5,6,7-tetrahydro-1*H*-indole (15m).** The title compound was prepared according to the general method from

(41) Pitts, M. R.; Harrison, J. R.; Moody, C. J. *J. Chem. Soc., Perkin Trans. 1* **2001**, 955–977.

(*E*)-2-bezylidenecyclohexanone[42] (224.1 mg, 1.20 mmol), amino-(phenyl)acetonitrile hydrochloride (**11a**·HCl,[28] 243.1 mg, 1.44 mmol, 1.2 equiv), 1 N $TiCl_4$ solution in dichloromethane (1.2 mL, 1.2 mmol), and triethylamine (732 $\mu$L, 5.28 mmol, 4.4 equiv). The reaction mixture was stirred for 90 min at 0 °C. The crude intermediate (green resin, 356.2 mg) was reacted to **15m** without further purification. A portion of the crude precursor (140.1 mg, 0.466 mmol) was reacted with KO-*t*-Bu (57.6 mg, 0.513 mmol) in DMF (1.40 mL) according to the general procedure. A portion (132.5 mg) of the crude pyrrole (160.1 mg) was purified by column chromatography (cyclohexane/ethyl acetate 10:1) to yield **15m** (19.7 mg, 0.072 mmol, 19%, 19% overall) as a yellow film: $R_f$ = 0.62 (cyclohexane/ ethyl acetate 5:1); IR (ATR) $\nu$ = 2925, 1599, 1527, 1503, 1491, 1442, 1070, 785, 755, 695, 593, 510 $cm^{-1}$; $^1H$ NMR, COSY (400 MHz, DMSO-$d_6$) $\delta$ = 10.71 (bs, 1H, NH), 7.39−7.13 (m, 9H, Ph), 7.07 (mc, 1H, H-4′), 2.60 (t, $J$ = 5.9 Hz, 2H, $H_2$-4), 2.34 (t, $J$ = 5.7 Hz, 2H, $H_2$-7), 1.77 (mc, 2H, $H_2$-5), 1.67 (mc, 2H, $H_2$-6); $^{13}C$ NMR, PENDANT, HSQC, HMBC (100.6 MHz, DMSO-$d_6$) $\delta$ = 136.9, 133.6 (C1′, C1″), 130.2 (C3), 129.4 (2C, C2″,6″), 128.1 (4C, C3′,6′, C3″,6″), 127.6 (C3a), 126.3 (2C, C2′,6′), 125.3 (C4″), 125.2 (C4′), 119.8 (C2), 116.6 (C7a), 23.5 (C6), 22.9 (C5), 22.5 (C4), 22.1 (C7); the NMR spectra showed the presence of impurities; EI-MS ($m/z$) 273 (100) $[M]^+$, 244 (52), 40 (36); FAB-HRMS calcd for $[C_{20}H_{19}N]^+$ 273.1518, found 273.1516.

(42) Poggi, R.; Saltini, P. *Gazz. Chim. Ital.* **1932**, *62*, 678–686.

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**Supporting Information Available:** General methods; procedures for the preparation of 4′-chloro-3-nitrochalcone and compounds **9**, **10**, **11b**, and **12g** including physical data, copies of $^1H$ and $^{13}C$ spectra, ORTEP plots, as well as crystallographic data. This material is available free of charge via the Internet at http://pubs.acs.org.