REACTIONS OF ALKYL (Z)-2-[(E)-2-CYANO-2-(2-PYRIDINYL)ETHENYL]AMINO-3-DIMETHYLAMINOPROPENOATES WITH C- AND N-NUCLEOPHILES. THE SYNTHESIS OF FUSED 2H,5H-PYRAN-2,5-DIONES, 4H-PYRIMIDIN-4-ONES, AND 1-HETEROARYL-1H-IMIDAZOLE-4-CARBOXYLATES

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Abstract - Alkyl (Z)-2-[(E)-2-cyano-2-(2-pyridinyl)ethenyl]amino-3-dimethylaminopropenoates (2) and (3) were transformed with C- and N-nucleophiles into alkyl 2-[2-cyano-2-(2-pyridinyl)ethenyl]amino-3-heteroarylpropenoates (10-13), 2H,5H-benzo-[b]pyran-2,5-diones (14) and (15), 2H,5H-pyran[4,3-b]pyran-2,5-dione (16), 2H,5H-pyran[3,2-c]benzo[b]pyran-2,5-dione (17), alkyl 2-[2-cyano-2-(2-pyridinyl)ethenyl]amino-3-arylamino- (28-40), and 3-heteroarylaminopropenoates (41-43), pyrido[1,2-a]pyrimidin-4-ones (50-53), thiazolo[3,2-a]pyrimidin-4-one (54), benzothiazolo[3,2-a]pyrimidin-4-one (55), and 1-heteroaryl-1H-imidazole-4-carboxylate (56). Compounds (28-43) exist in (2E,2′E) form or as a mixture of (2E,2′E) as a major and (2Z,2′E) form as a minor isomer.

α-Amino acids and their derivatives play an important role in organic synthesis,1-6 especially as building blocks for the preparation of many heterocyclic systems. Recently, several comprehensive reviews have been published describing the preparation of the following heterocyclic systems: pyranones and fused pyranones,7 fused pyridinones,8 fused pyrimidinones,9 pyrroles,10 pyrazoles,11 imidazoles,12 and 1,2,4-oxadiazoles.13

Quinolizines, pyridopyrimidines, benzopyrans, pyranopyrans and related fused systems are the basic structures of many alkaloids and their synthetic derivatives exhibiting various biological activity.14-18
Since there has been no general method known for the preparation of those heterocyclic systems, in which an amino acid is incorporated or partially incorporated into the heterocyclic ring, we have prepared a series of 2-substituted 3-dimethylaminopropenoates, 2-[(2,2-disubstituted ethenyl)amino]-3-dimethylaminopropenoates and related compounds, stable masked 2-formylglycine derivatives, as versatile reagents for the preparation of various heterocyclic systems, among others alkyl 3,4-disubstituted and alkyl 1-acyl-3,4-disubstituted pyrrole-2-carboxylates, and dialkyl 3-aminoypyrrrole-2,4-dicarboxylates, which have been further transformed into 5H-pyrrolo[3,2-d]pyrimidine derivatives, and other systems, including some natural products, such as aplysinopsins.

This methodology has opened also an easy access to substituted 4H-quinolizin-4-ones, pyridopyrimidines and other heterocyclic systems with an amino group in 3 position of the newly formed heterocyclic system. The substituents attached at 2,2-disubstituted ethenyl group of the substituted amino group are ester groups or a combinations of an ester and an acyl, two acyl, an ester and an amino, an ester and a cyano, two cyano, or an ester and a phenyl group.

Recently, alkyl (Z)-2-[(E)-2-cyano-2-(2-pyridinyl)ethenyl]amino-3-dimethylaminopropenoates (2) and (3) have been prepared from 2-pyridinylacetonitrile (1) in three steps (Scheme 1) and converted by heating in acetic acid into substituted 3-aminoypyrrrole-2-carboxylates and by treatment with aliphatic amines into 5H-pyrrolo[3,2-d]pyrimidin-4-ones.

Scheme 1

In this paper we report the transformations of compounds (2) and (3), with C- and N-nucleophiles into β-heteroaryl-, β-arylamino- and β-heteroarylamino-α,β-didehydro-α-amino acid derivatives, and various heterocyclic systems in which heteroaryl and cyano substituted ethenylamino groups are introduced into the newly formed ring.

Compounds (2) and (3) were treated with barbituric (4) and thiobarbituric acid (5) in acetic acid at room temperature for 1.5 to 2 h to form the corresponding 2-[2-cyano-2-(2-pyridinyl)ethenyl]aminopyrimidinyl-
propenoates (10-13) in 54-91% yield. By treatment with cyclohexane-1,3-diones (6) and (7) in acetic acid under reflux for several hours 5,6,7,8-tetrahydro-2H,5H-benzo[b]pyran-2,5-diones (14) and (15) were obtained in 27-48% yield. 4-Hydroxy-6-methyl-2H-pyran-2-one (8) and 4-hydroxy-2H-benzo[b]pyran-2-one (9) afforded 2H,5H-pyran[4,3-b]pyran-2,5-dione (16) and 2H,5H-pyran[3,2-c]benzo[b]pyran-2,5-dione (17) derivatives in 47-58% yield. (Scheme 2).

Since we have not isolated the noncyclized intermediates resulting from substitution of the dimethylamino group with aliphatic amines,34 we extended our studies to the reaction of compounds (2) and (3) with aromatic and heteroaromatic amines in order to prepare intermediates from which other heterocycles can be prepared. In this respect, compounds (2) and (3) were treated with anilines (18-25), 2-amino-5-chloropyridine (26), and 3-aminoisoxazole (27) in acetic acid for several hours at room
temperature to give alkyl 2-[2-cyano-2-(2-pyridinyl)ethenyl]amino-3-arylamino (or heteroarylamino)propenoates (28-43) in 70-99% yield with few exceptions. (Scheme 3).

Scheme 3

amine (R1NH2) | products |
--- | --- | --- |
18 | 28 Me | 36 Et |
19 | 29 Me | 37 Et |
20 | 30 Me | 38 Et |
21 | 31 Me | 39 Et |
22 | 32 Me | 40 Et |
23 | 33 Me | 41 Me |
24 | 34 Me | 42 Et |
25 | 35 Me | 43 Me |
26 | | |
27 | | |
Further transformations with $N$-nucleophiles can proceed in two different manners: with sterically unhindered heteroarylamines the reaction proceeds according to path A to form fused pyrimidin-4-ones, while with sterically hindered heteroarylamines the reaction proceeds according to path B to form 1-heteroaryl-1H-imidazole-4-carboxylates, similarly as observed earlier. Thus, compounds (2) and (3) react with pyridines (26, 44-46), 2-aminothiazole (47), and 2-aminobenzothiazole (48) to give 4H-pyrido[1,2-$a$]pyrimidin-4-ones (50-53), 5H-thiazolo[3,2-$a$]pyrimidin-4-one (54), and 4H-benzothiazolo[3,2-$a$]pyrimidin-4-one (55) derivatives, respectively, in low yields (11-42%), while 3-amino-5-methylisoxazole (49) gives 1-(5-methyl-3-isoxazolyl)-1H-imidazole-4-carboxylate (56) in 20% yield. (Scheme 4).

**Scheme 4**
STRUCTURE DETERMINATION

The structures of new compounds were determined on the basis of their MS spectra, elemental analyses for C, H, and N and \(^{1}H\) NMR spectra. In \(^{1}H\) NMR spectra of compounds (14-17) and (50-55) the chemical shifts for protons attached to the heteroaromatic systems are in agreement with the data reported earlier for other derivatives of these systems.\(^{19a}\) The protons attached to the substituted amino group show the following characteristics. The CHNH appear as doublets in the range of \(\delta = 7.68-7.93\) ppm and CHNH as doublets or broad singlet (compound (16)) in the range of \(\delta = 12.74-13.20\) ppm with the coupling constants \(J_{\text{CH-NH}} = 11.1-13.0\) Hz. From the chemical shifts one can conclude that the orientation around the C=C bond is \textit{trans} and from the magnitude of coupling constants that the orientation around the CHNH bond is \textit{trans (antiperiplanar)}.\(^{36}\) (Figure 1).

Figure 1

![Figure 1](image)

The compounds (28-43) show in \(^{1}H\) NMR spectra in deuteriochloroform one or two sets of signals indicating that they exist in (2\(E\), 2'\(E\)) and (2\(Z\), 2'\(E\)) forms with (2\(E\), 2'\(E\)) being the only one or the predominating form. The ratios between isomers were determined on the basis of peaks for methyl and ethyl groups in esters. The orientations around the both double bonds were deduced from analogous chemical shifts for CHNH and CHNH, and \(J_{\text{CH-NH}}\) coupling constants in \(^{1}H\) NMR spectra.\(^{36}\) In all cases the orientation in major isomer is \((E)\) for C(2)=C(3) and \((E)\) for C(2')=C(3'), while in the minor isomer the orientation is \((Z)\) around the C(2)=C(3) and \((E)\) around the C(2')=C(3') double bonds. (Table 1).

Table 1. Characteristic peaks in \(^{1}H\) NMR (CDCl\(_3\)) (\(\delta\) in ppm, J in Hz) for compounds (28-43).

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<th>(\delta_{R\text{-NHCH}})</th>
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EXPERIMENTAL

Melting points were taken on a Kofler micro hot stage. The $^1$H NMR spectra were obtained on a Bruker Avance DPX 300 (300 MHz) spectrometer in such solvent as DMSO-d$_6$ and CDCl$_3$ with TMS as the internal standard, MS spectra on an AutoSpecQ spectrometer, IR spectra on a Perkin-Elmer 1310 infrared spectrophotometer and elemental analyses for $C$, $H$ and $N$ on a Perkin-Elmer CHN Analyser 2400. Methyl and ethyl (Z)-2-[[(E)-2-cyano-2-(2-pyridinyl)ethenyl]amino-3-dimethylaminopropanoates 2 and 3 were prepared according to the procedure described in the literature.$^{34}$

General Procedure for the Preparation of $\beta$-Heteroaryl-$\alpha,\beta$-didehydro-$\alpha$-amino Acid Derivatives (10-13):

To compound (2) (136 mg, 0.5 mmol) or (3) (143 mg, 0.5 mmol) the corresponding aromatic amines (5) and (6) (0.5 mmol) and acetic acid (2 mL) were added and the mixture was stirred at rt for 1.5 to 2 h. The precipitate was collected by filtration and washed with ethanol.

Methyl 2-[2-Cyano-2-(2-pyridinyl)ethenyl]amino-3-(4-hydroxy-2,6-dioxo-5-pyrimidinyl)propenoate (10). This compound was prepared from compound (2) (136 mg, 0.5 mmol) and barbituric acid (5) (64 mg, 0.5 mmol), 2 h, 91% yield (162 mg), mp >350$^\circ$C (from ether), MS 355 (M$^+$), HRMS: Calcd: 355.091669, Found: 355.092530, IR 2200 cm$^{-1}$ (CN), 3400 cm$^{-1}$ (OH), $^1$H NMR (DMSO-d$_6$) $\delta$: 3.74 (3H, s, COOMe), 7.22 (1H, dd, J$_{H4-H5}$ = 7.7 Hz, J$_{H5-H6}$ = 6.0 Hz, H$_5$), 7.54 (1H, s, CH), 7.74 (1H, ddd, J$_{H3-H4}$ = 8.1 Hz, J$_{H4-H5}$ = 7.7 Hz, J$_{H4-H6}$ = 1.8 Hz, H$_4$), 7.99 (1H, d, J$_{H3-H4}$ = 8.1 Hz, H$_3$), 8.32 (1H, dd, J$_{H4-H6}$ = 1.8 Hz, J$_{H5-H6}$ = 6.0 Hz, H$_6$), 8.60 (1H, d, J$_{CH-NH}$ = 12.8 Hz, CHNH), 10.09 (2H, s, 2x NH), 13.31 (1H, br s, CHNH). Anal. Calcd for C$_{16}$H$_{13}$N$_5$O$_5$ + ½ H$_2$O: C, 52.75; H, 3.87; N, 19.22. Found: C, 52.52; H, 4.15; N, 19.25.

Ethyl 2-[2-Cyano-2-(2-pyridinyl)ethenyl]amino-3-(4-hydroxy-2,6-dioxo-5-pyrimidinyl)propenoate (11). This compound was prepared from compound (3) (143 mg, 0.5 mmol) and barbituric acid (5) (64 mg, 0.5 mmol), 1.5 h, 67% yield (124 mg), mp 149-153$^\circ$C (from ether), MS 369 (M$^+$), HRMS: Calcd: 369.107319, Found: 369.10798, IR 2190 cm$^{-1}$ (CN), 3420 cm$^{-1}$ (OH), $^1$H NMR (DMSO-d$_6$) $\delta$: 1.27 (3H, t, J$_{CH2-CH3}$ = 7.2 Hz, COOCH$_2$CH$_3$), 4.21 (2H, q, J$_{CH2-CH3}$ = 7.2 Hz, COOCH$_2$CH$_3$), 7.26 (1H, dd, J$_{H4-H5}$ = 7.0 Hz, J$_{H5-H6}$ = 5.3 Hz, H$_5$), 7.55 (1H, s, CH), 7.58 (1H, d, J$_{H3-H4}$ = 8.7 Hz, H$_3$), 8.04 (1H, dd, J$_{H3-H4}$ = 8.7 Hz, J$_{H4-H5}$ = 7.0 Hz, H$_4$), 8.31 (1H, d, J$_{H5-H6}$ = 5.3 Hz, H$_6$), 8.61 (1H, d, J$_{CH-NH}$ = 12.8 Hz, CHNH), 10.10
(2H, s, 2x NH), 13.43 (1H, br s, CHNH). Anal. Calcd for C_{17}H_{15}N_{5}O_{8} + 1 H_{2}O: C, 52.71; H, 4.42; N, 18.08. Found: C, 53.02; H, 4.75; N, 17.98.

**Methyl 2-[2-Cyano-2-(2-pyridinyl)ethenyl]amino-3-(4-hydroxy-2-thio-6-oxo-5-pyrimidinyl)propenoate (12).** This compound was prepared from compound (2) (136 mg, 0.5 mmol) and 2-thiobarbituric acid (6) (72 mg, 0.5 mmol), 2 h, 83% yield (154 mg), mp >350°C (from ether), MS 371 (M^+), HRMS: Calcd: 371.06826, Found: 371.06956, IR 2200 cm^{-1} (CN), 3460 cm^{-1} (OH), ^1H NMR (DMSO-d$_6$) δ: 3.76 (3H, s, COOMe), 7.29 (1H, dd, J$_{H4-H5}$ = 7.3 Hz, J$_{H5-H6}$ = 5.7 Hz, H$_5$), 7.45 (1H, s, CH), 7.60 (1H, d, J$_{H3-H4}$ = 8.7 Hz, H$_3$), 7.95 (1H, dd, J$_{H3-H4}$ = 8.7 Hz, J$_{H4-H5}$ = 7.3 Hz, H$_4$), 8.35 (1H, d, J$_{H5-H6}$ = 5.7 Hz, H$_6$), 8.58 (1H, d, J$_{CH-NH}$ = 13.2 Hz, CHNH), 11.37 (2H, s, 2x NH), 12.90 (1H, br s, CHNH). Anal. Calcd for C$_{16}$H$_{13}$N$_{5}$O$_{4}$S + ½ H$_{2}$O: C, 50.52; H, 3.71; N, 18.41. Found: C, 50.74; H, 3.70; N, 18.59.

**Ethyl 2-[2-Cyano-2-(2-pyridinyl)ethenyl]amino-3-(4-hydroxy-2-thio-6-oxo-5-pyrimidinyl)propenoate (13).** This compound was prepared from compound (3) (143 mg, 0.5 mmol) and 2-thiobarbituric acid (6) (72 mg, 0.5 mmol), 1.5 h, 54% yield (104 mg), mp 246-250°C (from ethanol (decomp)), MS 385 (M^+), HRMS: Calcd: 385.084476, Found: 385.08524, IR 2200 cm^{-1} (CN), 3440 cm^{-1} (OH), ^1H NMR (DMSO-d$_6$) δ: 1.27 (3H, t, J$_{CH2-CH3}$ = 7.1 Hz, COOCH$_2$CH$_3$), 4.24 (2H, q, J$_{CH2-CH3}$ = 7.1 Hz, COOC$_2$H$_5$), 7.35 (1H, ddd, J$_{H3-H5}$ = 0.8 Hz, J$_{H4-H5}$ = 7.1 Hz, J$_{H5-H6}$ = 6.1 Hz, H$_5$), 7.49 (1H, s, CH), 7.69 (1H, dd, J$_{H3-H4}$ = 8.7 Hz, J$_{H3-H5}$ = 0.8 Hz, H$_3$), 8.14 (1H, ddd, J$_{H3-H4}$ = 8.7 Hz, J$_{H4-H5}$ = 7.1 Hz, J$_{H4-H6}$ = 1.5 Hz, H$_4$), 8.35 (1H, dd, J$_{H4-H6}$ = 1.5 Hz, J$_{H5-H6}$ = 6.1 Hz, H$_6$), 8.61 (1H, d, J$_{CH-NH}$ = 13.2 Hz, CHNH), 11.41 (2H, s, 2x NH), 13.17 (1H, d, J$_{CH-NH}$ = 13.2 Hz, CHNH). Anal. Calcd for C$_{17}$H$_{13}$N$_{5}$O$_{4}$S: C, 52.98; H, 3.92; N, 18.17. Found: C, 52.77; H, 3.74; N, 17.95.

**General Procedure for the Preparation of Pyranones (14-17):**

To compound (2) (136 mg, 0.5 mmol) or (3) (143 mg, 0.5 mmol) the corresponding C-nucleophilic compounds (6-9) (0.5 mmol) and acetic acid (2 mL) were added and the mixture was heated under reflux for 0.5 to 6 h. The volatile compounds were evaporated in vacuo, ethanol (3 mL) was added and the precipitate was collected by filtration.

**3-[2-Cyano-2-(2-pyridinyl)ethenyl]amino-5,6,7,8-tetrahydro-2H,5H-benzo[b]pyran-2,5-dione (14).** This compound was prepared from compound (2) (136 mg, 0.5 mmol) and 1,3-cyclohexanedione (6) (56 mg, 0.5 mmol), 2 h, 41% yield (63 mg), and from compound (3) (143 mg, 0.5 mmol) and 1,3-cyclohexane-
dione (6) (56 mg, 0.5 mmol), 2.5 h, 27% yield (41 mg), mp 249-252°C (from a mixture of ethanol and toluene), IR 2220 cm⁻¹ (CN), ¹H NMR (CDCl₃) δ: 2.15-2.24 (2H, m, CH₂), 2.58-2.62 (2H, m, CH₂), 2.90 (2H, t, J.CH₂-CH₂ = 6.4 Hz, CH₂), 7.17 (1H, ddd, J₃₆-H₅ = 1.1 Hz, J₄₅-H₅ = 7.4 Hz, J₅₆-H₆ = 5.0 Hz, H₅'), 7.35 (1H, s, H₄), 7.58 (1H, ddd, J₃₆-H₄ = 8.1 Hz, J₃₅-H₅ = 1.1 Hz, J₃₅-H₆ = 0.9 Hz, H₃'), 7.69 (1H, d, J.CH-NH = 11.9 Hz, CHNH), 7.76 (1H, ddd, J₃₆-H₄ = 8.1 Hz, J₄₅-H₅ = 7.4 Hz, J₄₅-H₆ = 1.8 Hz, H₄'), 8.63 (1H, ddd, J₃₅-H₆ = 0.9 Hz, J₄₅-H₆ = 1.8 Hz, J₅₆-H₆ = 5.0 Hz, H₆'), 12.83 (1H, d, J.CH-NH = 11.9 Hz, CHNH). Anal. Calcd for C₁₇H₁₃N₃O₃: C, 66.44; H, 4.26; N, 3.67. Found: C, 66.13; H, 5.31; N, 13.49.

3-[2-Cyano-2-(2-pyridinyl)ethenyl]amino-7,7-dimethyl-5,6,7,8-tetrahydro-2H,5H-benzo[b]pyran-2,5-dione (15). This compound was prepared from compound (2) (136 mg, 0.5 mmol) and 5,5-dimethyl-1,3-cyclohexanedione (7) (70 mg, 0.5 mmol), 2 h, 48% yield (80 mg), and from compound (3) (143 mg, 0.5 mmol) and 5,5-dimethyl-1,3-cyclohexanedione (7) (70 mg, 0.5 mmol), 2.5 h, 36% yield (60 mg), mp 250-253°C (from ethanol), IR 2210 cm⁻¹ (CN), ¹H NMR (CDCl₃) δ: 1.17 (6H, s, 2x 7-Me), 2.46 (2H, s, CH₂), 2.75 (2H, s, CH₂), 7.17 (1H, ddd, J₃₆-H₅ = 1.1 Hz, J₄₅-H₅ = 7.5 Hz, J₅₆-H₆ = 4.9 Hz, H₅'), 7.34 (1H, s, H₄), 7.58 (1H, ddd, J₃₆-H₄ = 8.2 Hz, J₃₅-H₅ = 1.1 Hz, J₃₅-H₆ = 1.0 Hz, H₃'), 7.69 (1H, d, J.CH-NH = 11.9 Hz, CHNH), 7.76 (1H, ddd, J₃₆-H₄ = 8.2 Hz, J₄₅-H₅ = 7.5 Hz, J₄₅-H₆ = 1.8 Hz, H₄'), 8.63 (1H, ddd, J₃₅-H₆ = 1.0 Hz, J₄₅-H₆ = 1.8 Hz, J₅₆-H₆ = 4.9 Hz, H₆'), 12.84 (1H, d, J.CH-NH = 11.9 Hz, CHNH). Anal. Calcd for C₁₅H₁₂N₂O₃: C, 68.05; H, 5.11; N, 12.53. Found: C, 68.13; H, 5.31; N, 12.44.

3-[2-Cyano-2-(2-pyridinyl)ethenyl]amino-7-methyl-2H,5H-pyran-4,3-b-pyran-2,5-dione (16). This compound was prepared from compound (2) (136 mg, 0.5 mmol) and 4-hydroxy-6-methyl-2H-pyran-2-one (8) (63 mg, 0.5 mmol), 6 h, 2.5 h, 49% yield (79 mg), and from compound (3) (143 mg, 0.5 mmol) and 4-hydroxy-6-methyl-2H-pyran-2-one (8) (63 mg, 0.5 mmol), 2.5 h, 51% yield (82 mg), mp 305-308°C (from a mixture of ethanol and toluene), IR 2230 cm⁻¹ (CN), ¹H NMR (CDCl₃) δ: 2.37 (3H, d, J₃₆-H₈ = 0.9 Hz, 7-Me), 6.23 (1H, d, J₇₇-Me-H₈ = 0.9 Hz, H₇), 7.19 (1H, ddd, J₃₆-H₅ = 1.0 Hz, J₄₅-H₅ = 7.5 Hz, J₅₆-H₆ = 5.0 Hz, H₅'), 7.35 (1H, s, H₄), 7.61 (1H, ddd, J₃₆-H₄ = 8.1 Hz, J₃₅-H₅ = 1.0 Hz, J₃₅-H₆ = 1.0 Hz, H₃'), 7.68 (1H, d, J.CH-NH = 12.0 Hz, CHNH), 7.78 (1H, ddd, J₃₆-H₄ = 8.1 Hz, J₄₅-H₅ = 7.5 Hz, J₄₅-H₆ = 1.9 Hz, H₄'), 8.64 (1H, ddd, J₃₅-H₆ = 1.0 Hz, J₄₅-H₆ = 1.9 Hz, J₅₆-H₆ = 5.0 Hz, H₆'), 13.08 (1H, br s, CHNH). Anal. Calcd for C₁₇H₁₁N₃O₄: C, 63.55; H, 3.45; N, 13.08. Found: C, 63.80; H, 3.37; N, 13.35.

3-[2-Cyano-2-(2-pyridinyl)ethenyl]amino-2H,5H-pyran-3,2-c-benzo[b]pyran-2,5-dione (17). This compound was prepared from compound (2) (136 mg, 0.5 mmol) and 4-hydroxy-2H-benzo[b]pyran-2-one (9) (81 mg, 0.5 mmol), 1.5 h, 47% yield (84 mg), and from compound (3) (143 mg, 0.5 mmol) and 4-
hydroxy-2H-benzo[b]pyran-2-one (9) (81 mg, 0.5 mmol), 30 min, 58% yield (104 mg), mp 329-327°C (from ethanol), IR 2260 cm\(^{-1}\) (CN), \(^1\)H NMR (CDCl\(_3\)) \(\delta\): 7.22 (1H, ddd, \(J_{H3',H5'} = 1.1\) Hz, \(J_{H4',H5'} = 7.6\) Hz, \(J_{H5'-H6'} = 5.1\) Hz, \(H_5'\)), 7.42 (1H, dd, \(J_{H7-H8} = 8.4\) Hz, \(J_{H7-H9} = 1.2\) Hz, \(H_7\)), 7.43 (1H, ddd, \(J_{H7-H9} = 1.2\) Hz, \(J_{H8-H9} = 7.2\) Hz, \(J_{H9-H10} = 8.4\) Hz, \(H_9\)), 7.48 (1H, s, \(H_4\)), 7.51 (1H, ddd, \(J_{H7-H9} = 1.7\) Hz, \(J_{H8-H9} = 7.2\) Hz, \(J_{H9-H10} = 1.4\) Hz, \(H_9\)), 7.74 (1H, d, \(J_{CH-NH} = 11.1\) Hz, CHNH), 7.81 (1H, ddd, \(J_{H3'-H4'} = 8.3\) Hz, \(J_{H4'-H5'} = 7.6\) Hz, \(J_{H4'-H6'} = 1.9\) Hz, \(H_4'\)), 8.05 (1H, dd, \(J_{H8-H9} = 1.4\) Hz, \(J_{H9-H10} = 8.4\) Hz, \(H_9\)), 8.68 (1H, d, \(J_{CH-NH} = 11.1\) Hz, CHNH). Anal. Caled for C\(_{20}\)H\(_{11}\)N\(_3\)O\(_4\): C, 67.23; H, 3.10; N, 11.76. Found: C, 67.59; H, 2.92; N, 11.98.

**General Procedure for the Preparation of β-Arylamino-α,β-didehydro-α-amino Acid Derivatives (28-40):**

To compound (2) (136 mg, 0.5 mmol) or (3) (143 mg, 0.5 mmol) the corresponding aromatic amines (18-25) (0.5 mmol) and acetic acid (2 mL) were added and the mixture was stirred at rt for several hours. The volatile compounds were evaporated in vacuo, ethanol (3 mL) was added and the precipitate was collected by filtration.

**Methyl (E)-2-[(E)-2-Cyano-2-(2-pyridinyl)ethenyl]amino-3-phenylaminopropenoate (28).** This compound was prepared from compound (2) (136 mg, 0.5 mmol) and aniline (18) (47 mg, 0.5 mmol), 5.5 h, 80% yield (128 mg), mp 182-186°C (from ethanol), IR 2210 cm\(^{-1}\) (CN), \(^1\)H NMR (CDCl\(_3\)) \(\delta\): 3.80 (3H, s, COOMe), 6.65 (1H, d, \(J_{R1NH-CH} = 13.2\) Hz, \(R_1NHCH\)), 7.00-7.03 (2H, m, 2H(Ph)), 7.04 (1H, d, \(J_{CH-NH} = 10.4\) Hz, CHNH), 7.07 (1H, ddd, \(J_{H3'-H5'} = 1.1\) Hz, \(J_{H4'-H5'} = 7.4\) Hz, \(J_{H5'-H6'} = 5.0\) Hz, \(H_5'\)), 7.31-7.36 (3H, m, 3H(Ph)), 7.52 (1H, ddd, \(J_{H3'-H4'} = 8.2\) Hz, \(J_{H3'-H5'} = 1.1\) Hz, \(J_{H3'-H6'} = 1.0\) Hz, \(H_3'\)), 7.72 (1H, ddd, \(J_{H3'-H4'} = 8.2\) Hz, \(J_{H4'-H5'} = 7.4\) Hz, \(J_{H4'-H6'} = 1.8\) Hz, \(H_4'\)), 7.91 (1H, d, \(J_{R1NH-CH} = 13.2\) Hz, \(R_1NHCH\)), 8.46 (1H, ddd, \(J_{H3'-H6'} = 1.0\) Hz, \(J_{H4'-H6'} = 1.8\) Hz, \(J_{H5'-H6'} = 5.0\) Hz, \(H_6'\)), 11.24 (1H, d, \(J_{CH-NH} = 10.4\) Hz, CHNH). Anal. Caled for C\(_{15}\)H\(_{16}\)N\(_4\)O\(_2\): C, 67.49; H, 5.03; N, 17.49. Found: C, 67.48; H, 4.96; N, 17.51.

**Methyl (E)-2-[(E)-2-Cyano-2-(2-pyridinyl)ethenyl]amino-3-(2-methoxyphenyl)aminopropenoate (29).** This compound was prepared from compound (2) (136 mg, 0.5 mmol) and 2-methoxyaniline (19) (62 mg, 0.5 mmol), 5 h, 77% yield (135 mg), mp 189-193°C (from ethanol), IR 2200 cm\(^{-1}\) (CN), \(^1\)H NMR (CDCl\(_3\)) \(\delta\): 3.87 (3H, s, COOMe), 3.95 (3H, s, OMe), 6.90-7.09 (4H, m, 4H(Ph)), 7.03 (1H, ddd, \(J_{H3'-H5'} = 1.1\) Hz, \(J_{H4'-H5'} = 7.4\) Hz, \(J_{H5'-H6'} = 5.0\) Hz, \(H_5'\)), 7.27 (1H, d, \(J_{CH-NH} = 11.6\) Hz, CHNH), 7.43 (1H, d, \(J_{R1NH-CH} =
Methyl (E)-2-[(E)-2-Cyano-2-(2-pyridinyl)ethenyl]amino-3-(4-methoxyphenyl)aminopropenoate and (Z)-2-[(E)-Isomer (30)]. These compounds were prepared from compound (2) (136 mg, 0.5 mmol) and 4-methoxyaniline (20) (62 mg, 0.5 mmol) in 3:1 ratio, 24 h, 75% yield (131 mg), mp 143-155°C (from ethanol), IR 2210 cm⁻¹ (CN), ¹H NMR (CDCl₃) δ: (2E, 2'E): 3.77, 3.79 (6H, 2x s, COOMe, OMe), 6.59 (1H, d, J₁NH-CH = 13.2 Hz, R₁NHC₆H₅), 6.86-6.98 (4H, m, 4H(Ph)), 7.05 (1H, d, J₃H₃'-H₅' = 1.1 Hz, J₄H₄'-H₅' = 7.4 Hz, J₃H₃'-H₅' = 5.0 Hz, H₃'), 7.24 (1H, d, J₁CH-NH = 11.7 Hz, CHNH), 7.50 (1H, d, J₃H₃'-H₄' = 8.2 Hz, J₃H₃'-H₅' = 1.1 Hz, J₃H₃'-H₆' = 1.0 Hz, H₅'), 7.70 (1H, d, J₃H₃'-H₄' = 8.2 Hz, J₄H₄'-H₅' = 7.4 Hz, J₄H₄'-H₆' = 1.8 Hz, H₄'), 7.82 (1H, d, J₁R₁NH-CH = 13.2 Hz, R₁NHCH), 8.45 (1H, d, J₃H₃'-H₆' = 1.0 Hz, J₄H₄'-H₆' = 1.8 Hz, J₅H₅'-H₆' = 5.0 Hz, H₆'), 9.11 (1H, d, J₁CH-NH = 11.7 Hz, CHNH). Addition of D₂O causes the loss of d at δ = 6.59 ppm and d at δ = 11.16 ppm; d at δ = 7.24 ppm turns to s and d at δ = 7.82 turns to s. (2Z, 2'E): 3.80, 3.84 (6H, 2x s, COOMe, OMe), 7.02 (1H, d, J₃H₃'-H₅' = 1.1 Hz, J₄H₄'-H₅' = 7.4 Hz, J₅H₅'-H₆' = 5.0 Hz, H₅'), 7.30 (1H, d, J₁CH-NH = 11.7 Hz, CHNH), 7.32 (1H, d, J₁R₁NH-CH = 13.2 Hz, R₁NHCH), 7.46 (1H, d, J₃H₃'-H₄' = 8.2 Hz, J₃H₃'-H₅' = 1.1 Hz, J₃H₃'-H₆' = 1.0 Hz, H₃'), 7.67 (1H, d, J₃H₃'-H₄' = 8.2 Hz, J₄H₄'-H₅' = 7.4 Hz, J₄H₄'-H₆' = 1.8 Hz, H₄'), 8.43 (1H, d, J₃H₃'-H₆' = 1.0 Hz, J₄H₄'-H₆' = 1.8 Hz, J₅H₅'-H₆' = 5.0 Hz, H₆'), 9.55 (1H, d, J₁R₁NH-CH = 13.2 Hz, R₁NHCH), 11.45 (1H, d, J₁CH-NH = 11.7 Hz, CHNH). Addition of D₂O causes the loss of d at δ = 9.55 ppm and d at δ = 11.45 ppm; d at δ = 7.30 ppm turns to s and d at δ = 7.32 turns to s. Anal. Calcd for C₁₉H₁₈N₄O₃: C, 65.13; H, 5.18; N, 15.99. Found: C, 65.38; H, 5.02; N, 16.12.

Methyl (E)-2-[(E)-2-Cyano-2-(2-pyridinyl)ethenyl]amino-3-(4-fluorophenyl)aminopropenoate and (Z)-2-[(E)-Isomer (31)]. These compounds were prepared from compound (2) (136 mg, 0.5 mmol) and 4-fluoroaniline (21) (56 mg, 0.5 mmol) in 3:1 ratio, 3 h, 85% yield (144 mg), mp 201-205°C (from ethanol), IR 2180 cm⁻¹ (CN), ¹H NMR (CDCl₃) δ: (2E, 2'E): 3.78 (3H, s, COOME), 6.78 (1H, d, J₁R₁NH-CH = 13.1 Hz, R₁NHC₆H₅), 6.94-7.07 (5H, m, H₅', 4H(Ph)), 7.24 (1H, d, J₁CH-NH = 12.4 Hz, CHNH), 7.45 (1H, d, J₃H₃'-H₄' = 8.2 Hz, J₃H₃'-H₅' = 1.0 Hz, J₃H₃'-H₆' = 1.0 Hz, H₃'), 7.67 (1H, d, J₃H₃'-H₄' = 8.2 Hz, J₄H₄'-H₅' = 7.5 Hz, J₄H₄'-H₆' = 1.8 Hz, H₄'), 7.80 (1H, d, J₁R₁NH-CH = 13.1 Hz, R₁NHCH), 8.45 (1H, d, J₃H₃'-H₆' = 1.0 Hz, J₄H₄'-H₆' = 1.8 Hz, J₅H₅'-H₆' = 5.0 Hz, H₆'), 11.20 (1H, d, J₁CH-NH = 12.4 Hz, CHNH). (2Z, 2'E): 3.85 (3H, s, COOMe), 7.28 (1H, d, J₁CH-NH = 12.4 Hz, CHNH), 7.32 (1H, d, J₁R₁NH-CH = 13.1 Hz, R₁NHCH), 8.43 (1H, d, J₃H₃'-H₆' = 1.0 Hz, J₄H₄'-H₆' = 1.8 Hz, J₅H₅'-H₆' = 5.0 Hz, H₆'), 9.60 (1H, d, J₁R₁NH-CH = 13.1 Hz, R₁NHCH), 11.50 (1H, d,
Methyl (E)-2-[(E)-2-Cyano-2-(2-pyridinyl)ethenyl]amino-3-(3-chloro-4-fluorophenyl)aminopropenoate and (Z)-2-[(E)- Isomer (32). These compounds were prepared from compound (2) (136 mg, 0.5 mmol) and 3-chloro-4-fluoroaniline (22) (73 mg, 0.5 mmol) in 7:1 ratio, 1.5 h, 90% yield (168 mg), mp 213-215°C (from ethanol), IR 2180 cm⁻¹ (CN), ¹H NMR (CDCl₃) δ: (2E, 2′E): 3.80 (3 H, s, COOME), 6.58 (1H, d, J₉₁NH-CH = 13.2 Hz, R₁NHCH), 6.84-6.89 (1H, m, 1H(Ph)), 7.07 (1H, ddd, J₉₃-H₅ = 1.1 Hz, J₉₄-H₅ = 7.4 Hz, J₉₅-H₆ = 5.1 Hz, H₅′), 7.06-7.14 (2H, m, 2H(Ph)), 7.24 (1H, d, J₉₁NH = 10.7 Hz, CHNH), 7.52 (1H, ddd, J₉₃-H₄ = 8.2 Hz, J₉₃-H₅ = 1.1 Hz, J₉₃-H₆ = 1.0 Hz, H₃′), 7.72 (1H, ddd, J₉₃-H₄ = 8.2 Hz, J₉₄-H₅ = 7.4 Hz, J₉₄-H₆ = 1.9 Hz, H₄′), 7.75 (1H, d, J₉₁NH-CH = 13.2 Hz, R₁NHCH), 8.45 (1H, ddd, J₉₃-H₆ = 1.0 Hz, J₉₄-H₆ = 1.9 Hz, J₉₅-H₆ = 5.1 Hz, H₆′), 11.25 (1H, d, J₉₁NH = 10.7 Hz, CHNH). (2Z, 2′E): 3.86 (3H, s, COOME), 7.29 (1H, d, J₉₁NH = 10.7 Hz, CHNH), 7.48 (1H, ddd, J₉₃-H₄ = 8.2 Hz, J₉₃-H₅ = 1.1 Hz, J₉₃-H₆ = 1.0 Hz, H₃′), 7.69 (1H, ddd, J₉₃-H₄ = 8.2 Hz, J₉₄-H₅ = 7.4 Hz, J₉₄-H₆ = 1.9 Hz, H₄′), 8.43 (1H, ddd, J₉₃-H₆ = 1.0 Hz, J₉₄-H₆ = 1.9 Hz, J₉₅-H₆ = 5.1 Hz, H₆′), 9.60 (1H, d, J₉₁NH-CH = 13.2 Hz, R₁NHCH), 11.55 (1H, d, J₉₁NH = 10.7 Hz, CHNH). Anal. Calcd for C₁₈H₁₅N₄O₂F: C, 63.90; H, 4.47; N, 8.4. Found: C, 63.96; H, 4.43; N, 16.70.

Methyl (E)-2-[(E)-2-Cyano-2-(2-pyridinyl)ethenyl]amino-3-(2-bromophenyl)aminopropenoate and (Z)-2-[(E)- Isomer (33). These compounds were prepared from compound (2) (136 mg, 0.5 mmol) and 2-bromoaniline (23) (86 mg, 0.5 mmol) in 3:2 ratio, 2.5 h, 61% yield (122 mg), mp 218-221°C (from ethanol), IR 2190 cm⁻¹ (CN), ¹H NMR (CDCl₃) δ: (2E, 2′E): 3.83 (3H, s, COOME), 6.87-6.94 (1H, m, 1H(Ph)), 7.07 (1H, ddd, J₉₃-H₅ = 1.1 Hz, J₉₄-H₅ = 7.4 Hz, J₉₅-H₆ = 5.1 Hz, H₅′), 7.10-7.20 (1H, m, 1H(Ph)), 7.16 (1H, d, J₉₁NH-CH = 12.7 Hz, R₁NHCH), 7.29 (1H, d, J₉₁NH = 12.4 Hz, CHNH), 7.30-7.36 (1H, m, 1H(Ph)), 7.54 (1H, ddd, J₉₃-H₄ = 8.2 Hz, J₉₃-H₅ = 1.1 Hz, J₉₃-H₆ = 1.0 Hz, H₃′), 7.52-7.59 (1H, m, 1H(Ph)), 7.73 (1H, ddd, J₉₃-H₄ = 8.2 Hz, J₉₄-H₅ = 7.4 Hz, J₉₄-H₆ = 1.9 Hz, H₄′), 7.81 (1H, d, J₉₁NH-CH = 12.7 Hz, R₁NHCH), 8.47 (1H, ddd, J₉₃-H₆ = 1.0 Hz, J₉₄-H₆ = 1.9 Hz, J₉₅-H₆ = 5.1 Hz, H₆′), 11.67 (1H, d, J₉₁NH = 12.4 Hz, CHNH). (2Z, 2′E): 3.91 (3H, s, COOME), 7.04 (1H, ddd, J₉₃-H₅ = 1.1 Hz, J₉₄-H₅ = 7.4 Hz, J₉₅-H₆ = 5.1 Hz, H₅′), 7.38 (1H, d, J₉₁NH = 12.4 Hz, CHNH), 7.48 (1H, ddd, J₉₃-H₄ = 8.2 Hz, J₉₃-H₅ = 1.1 Hz, J₉₄-H₅ = 1.0 Hz, H₃′), 7.50 (1H, d, J₉₁NH-CH = 12.7 Hz, R₁NHCH), 7.69 (1H, ddd, J₉₃-H₄ = 8.2 Hz, J₉₄-H₅ = 7.4 Hz, J₉₄-H₆ = 1.9 Hz, H₄′), 8.45 (1H, ddd, J₉₃-H₆ = 1.0 Hz, J₉₄-H₆ = 1.9 Hz, J₉₅-H₆ = 5.1 Hz, H₆′), 10.05 (1H, d, J₉₁NH-CH = 12.7 Hz, R₁NHCH). Anal. Calcd for C₁₈H₁₅N₄O₂Br: C, 54.15; H, 3.79; N, 14.03. Found: C, 54.30; H, 3.70; N, 14.12.
Methyl (E)-2-[(E)-2-Cyano-2-(2-pyridinyl)ethenyl]amino-3-(3-bromophenyl)aminopropenoate and (Z)-2-[(E)- Isomer (34). These compounds were prepared from compound (2) (136 mg, 0.5 mmol) and 3-bromoaniline (24) (86 mg, 0.5 mmol) in 3:1 ratio, 4 h, 80% yield (160 mg), mp 203-210°C (from ethanol), IR 2190 cm⁻¹ (CN), ¹H NMR (CDCl₃) δ: (2E, 2'E): 3.81 (3H, s, COOMe), 6.66 (1H, d, Jₚₕₖ₇=12.7 Hz, R₁CH), 6.90-6.95 (1H, m, 1H(Ph)), 7.07 (1H, ddd, Jₚₕ₅=1.1 Hz, Jₚₕ₄ₕ₇=7.5 Hz, Jₕ₅ₖ₆=5.0 Hz, H₅), 7.16-7.20 (3H, m, 3H(Ph)), 7.25 (1H, d, Jₕ₄ₕ₅=11.7 Hz, CHNH), 7.51 (1H, ddd, Jₕ₃ₕ₄=8.2 Hz, Jₚₕ₃ₖ₅=1.1 Hz, Jₚₕ₃₆=1.0 Hz, H₃'), 7.87 (3H, t, Jₕ₃ₖ₆=11.7 Hz, CHNH), 8.46 (1H, ddd, Jₚₕ₄ₕ₆=1.0 Hz, Jₚₕ₄₆=1.9 Hz, Jₕ₃ₖ₄=5.0 Hz, H₃'), 8.72 (1H, d, Jₚₕ₆₇=12.7 Hz, Rₚ₇CH), 9.18-9.20 (3H, t, Jₕ₄ₖ₅=11.7 Hz, CHNH). (2Z, 2'E): 3.86 (3H, s, COOMe), 7.04 (1H, ddd, Jₚₕ₃₄=1.1 Hz, Jₚₕ₄ₕ₅=7.5 Hz, Jₚₕ₃₃₆=5.0 Hz, H₃'), 7.30 (1H, d, Jₚₕ₆₇=11.7 Hz, CHNH), 7.33 (1H, d, Jₚₕ₄ₖ₇=12.7 Hz, Rₚ₇CH), 7.48 (1H, ddd, Jₙₚₕ₃₄=8.2 Hz, Jₚₕ₃₅=1.1 Hz, Jₚₕ₃₆=1.0 Hz, H₃'), 7.69 (1H, ddd, Jₚₕ₃₄=8.2 Hz, Jₚₕ₃₅=1.1 Hz, Jₚₕ₃₆=1.0 Hz, H₃'), 8.39 (1H, ddd, Jₚₕ₄ₖ₅=1.0 Hz, Jₚₕ₄ₖ₆=1.9 Hz, Jₚₕ₃₃₆=5.0 Hz, H₃'), 9.62 (1H, d, Jₚₕ₆₇=12.7 Hz, Rₚ₇CH), 11.57 (1H, d, Jₚₖ₃₄=11.7 Hz, CHNH). Anal. Calcd for C₁₈H₁₅N₃O₂Br: C, 54.15; H, 3.79; N, 14.03. Found: C, 54.38; H, 3.56; N, 14.22.

Methyl (E)-2-[(E)-2-Cyano-2-(2-pyridinyl)ethenyl]amino-3-(3-nitrophenyl)aminopropenoate and (Z)-2-[(E)- Isomer (35). These compounds were prepared from compound (2) (136 mg, 0.5 mmol) and 3-nitroaniline (25) (69 mg, 0.5 mmol) in 5:1 ratio, 4 h, 99% yield (181 mg), mp 200-208°C (from ethanol), IR 2180 cm⁻¹ (CN), ¹H NMR (CDCl₃) δ: (2E, 2'E): 3.83 (3H, s, COOMe), 7.07 (1H, d, Jₚₕ₆₇=12.1 Hz, Rₚ₇CH), 7.08 (1H, ddd, Jₚₕ₄ₕ₅=1.1 Hz, Jₚₕ₄ₕ₆=7.4 Hz, Jₕ₄ₖ₆=5.0 Hz, H₃'), 7.31 (1H, br s, CHNH), 7.51-7.35 (1H, m, 1H(Ph)), 7.47 (1H, ddd, Jₚₕ₄ₕ₅=8.2 Hz, Jₚₕ₃₅=1.1 Hz, Jₚₕ₃₆=1.0 Hz, H₃'), 7.47-7.53 (1H, m, 1H(Ph)), 7.69 (1H, ddd, Jₚₕ₃₄=8.2 Hz, Jₚₕ₄ₕ₅=7.4 Hz, Jₚₕ₄ₖ₆=1.9 Hz, H₃'), 7.84-7.90 (2H, m, 2H(Ph)), 7.87 (1H, d, Jₚ₆₇₈=12.1 Hz, Rₚ₇CH), 8.46 (1H, ddd, Jₚ₄₆₇=1.0 Hz, Jₚ₆₇₈=1.9 Hz, Jₚ₄₅₆=5.0 Hz, H₆'), 9.85 (1H, d, Jₚ₄₅₆=12.5 Hz, CHNH). (2Z, 2'E): 3.89 (3H, s, COOMe), 7.41 (1H, d, Jₚ₆₇₈=12.1 Hz, Rₚ₇CH), 7.86 (1H, d, Jₚ₆₇₈=12.1 Hz, Rₚ₇CH), 8.45 (1H, ddd, Jₚ₃₅₆=1.0 Hz, Jₚ₃₄₅=1.9 Hz, Jₚ₃₄₆=5.0 Hz, H₆'), 11.67 (1H, d, Jₚ₄₅₆=12.5 Hz, CHNH). Anal. Calcd for C₁₈H₁₅N₃O₄: C, 59.18; H, 4.14; N, 19.17. Found: C, 59.03; H, 4.16; N, 19.26.

Ethyl (E)-2-[(E)-2-Cyano-2-(2-pyridinyl)ethenyl]amino-3-phenylaminopropenoate and (Z)-2-[(E)- Isomer (36). These compounds were prepared from compound (3) (143 mg, 0.5 mmol) and aniline (18) (47 mg, 0.5 mmol) in 8:1 ratio, 24 h, 61% yield (102 mg), mp 181-183°C (from ethanol), IR 2190 cm⁻¹ (CN), ¹H NMR (CDCl₃) δ: (2E, 2'E): 1.38 (3H, t, Jₕ₈₁₉=7.1 Hz, COOCH₂CH₃), 4.32 (2H, q, Jₕ₈₁₉=
Ethyl (E)-2-[(E)-2-Cyano-2-(2-pyridinyl)ethenyl]amino-3-(2-methoxyphenyl)aminopropanoate (37).

This compound was prepared from compound (3) (143 mg, 0.5 mmol) and 2-methoxyaniline (19) (62 mg, 0.5 mmol), 24 h, 79% yield (144 mg), mp 177-189°C (from ethanol), IR 2190 cm\(^{-1}\) (CN), \(^1\)H NMR (CDCl\(_3\)) \(\delta\): 1.39 (3H, t, J\(_{CH2-CH3}\) = 7.1 Hz, COOCH\(_2\)CH\(_3\)), 3.94 (3H, s, OMe), 4.34, (2H, q, J\(_{CH2-CH3}\) = 7.1 Hz, COOCH\(_2\)CH\(_3\)), 6.89-7.09 (4H, m, 4H(Ph)), 7.02 (1H, ddd, J\(_{H3'-H5'}\) = 1.1 Hz, J\(_{H4'-H5'}\) = 7.4 Hz, J\(_{H5'-H6'}\) = 5.0 Hz, H\(_5'\)), 7.30 (1H, d, J\(_{CH-NH}\) = 12.4 Hz, CHNH), 7.41 (1H, d, J\(_{R1NH-CH}\) = 13.0 Hz, R\(_1\)NHCH), 7.47 (1H, ddd, J\(_{H3'-H4'}\) = 8.2 Hz, J\(_{H3'-H5'}\) = 1.1 Hz, J\(_{H3'-H6'}\) = 1.0 Hz, H\(_3'\)), 7.67 (1H, ddd, J\(_{H3'-H4'}\) = 8.2 Hz, J\(_{H4'-H5'}\) = 7.4 Hz, J\(_{H4'-H6'}\) = 1.9 Hz, H\(_6'\)), 8.43 (1H, ddd, J\(_{H3'-H6'}\) = 1.0 Hz, J\(_{H4'-H6'}\) = 1.8 Hz, J\(_{H5'-H6'}\) = 5.0 Hz, H\(_6'\)), 9.80 (1H, d, J\(_{R1NH-CH}\) = 13.0 Hz, R\(_1\)NHCH), 11.72 (1H, d, J\(_{CH-NH}\) = 12.4 Hz, CHNH). \textit{Anal.} Calced for C\(_{20}\)H\(_{20}\)N\(_4\)O\(_3\): C, 65.92; H, 5.53; N, 15.37. Found: C, 66.02; H, 5.5; N, 15.12.

Ethyl (E)-2-[(E)-2-Cyano-2-(2-pyridinyl)ethenyl]amino-3-(4-fluorophenyl)aminopropanoate (38).

This compound was prepared from compound (3) (143 mg, 0.5 mmol) and 4-fluoroaniline (21) (56 mg, 0.5 mmol), 24 h, 70% yield (123 mg), mp 202-205°C (from ethanol), IR 2190 cm\(^{-1}\) (CN), \(^1\)H NMR (CDCl\(_3\)) \(\delta\): 1.38 (3H, t, J\(_{CH2-CH3}\) = 7.1 Hz, COOCH\(_2\)CH\(_3\)), 4.31 (2H, q, J\(_{CH2-CH3}\) = 7.1 Hz, COOCH\(_2\)CH\(_3\)), 6.93-6.99 (2H, m, 2H(Ph)), 7.01-7.07 (2H, m, 2H(Ph)), 7.03 (1H, ddd, J\(_{H3'-H5'}\) = 1.1 Hz, J\(_{H4'-H5'}\) = 7.4 Hz, J\(_{H5'-H6'}\) = 5.0 Hz, H\(_5'\)), 7.28 (1H, d, J\(_{CH-NH}\) = 12.7 Hz, CHNH), 7.29 (1H, d, J\(_{R1NH-CH}\) = 12.5 Hz, R\(_1\)NHCH), 7.47 (1H, ddd, J\(_{H3'-H4'}\) = 8.2 Hz, J\(_{H3'-H5'}\) = 1.1 Hz, J\(_{H3'-H6'}\) = 1.0 Hz, H\(_3'\)), 7.68 (1H, ddd, J\(_{H3'-H4'}\) = 8.2 Hz, J\(_{H4'-H5'}\) = 7.4 Hz, J\(_{H4'-H6'}\) = 1.8 Hz, H\(_6'\)), 8.42 (1H, ddd, J\(_{H3'-H6'}\) = 1.0 Hz, J\(_{H4'-H6'}\) = 1.8 Hz, J\(_{H5'-H6'}\) = 5.0 Hz, H\(_6'\)), 9.58 (1H, d, J\(_{R1NH-CH}\) = 12.5 Hz, R\(_1\)NHCH), 11.67 (1H, d, J\(_{CH-NH}\) = 12.7 Hz, CHNH). \textit{Anal.} Calced for C\(_{19}\)H\(_{17}\)N\(_4\)O\(_2\): C, 64.76; H, 4.86; N, 15.90. Found: C, 64.91; H, 4.83; N, 15.61.
Ethyl (E)-2-[((E)-2-Cyano-2-(2-pyridinyl)ethenyl)amino-3-(3-bromophenyl)aminopropenoate and (Z)-2-[((E)- Isomer (39)]. These compounds were prepared from compound (3) (143 mg, 0.5 mmol) and 3-bromoaniline (24) (86 mg, 0.5 mmol) in 2:1 ratio, 24 h, 35% yield (72 mg), mp 143-163°C (from ethanol), IR 2180 cm⁻¹ (CN), ¹H NMR (CDCl₃) δ: (2E, 2'E): 1.33 (3H, t, JCH₂-CH₃ = 7.1 Hz, COOCH₂CH₃), 4.27 (2H, q, JCH₂-CH₃ = 7.1 Hz, COOCH₂CH₃), 6.73 (1H, d, JR₁NH-CH = 12.8 Hz, R₁NHC₃H), 6.89-6.95 (1H, m, 1H(Ph)), 7.07 (1H, ddd, JH₃'-H₅' = 1.1 Hz, JH₄'-H₅' = 7.4 Hz, JH₅'-H₆' = 5.0 Hz, H₅'), 7.15-7.19 (3H, m, 3H(Ph)), 7.29 (1H, d, JCH-NH = 12.3 Hz, CHNH), 7.49 (1H, ddd, JH₃'-H₄' = 8.2 Hz, JH₃'-H₅' = 1.1 Hz, JH₅'-H₆' = 1.0 Hz, H₃'), 7.70 (1H, ddd, JH₃'-H₄' = 8.2 Hz, JH₄'-H₅' = 7.4 Hz, JH₄'-H₆' = 1.8 Hz, H₄'), 7.78 (1H, d, JR₁NH-CH = 12.8 Hz, R₁NHC₃H), 8.45 (1H, ddd, JH₃'-H₆' = 1.0 Hz, JH₄'-H₆' = 1.8 Hz, JH₅'-H₆' = 5.0 Hz, H₆'), 11.29 (1H, d, JCH-NH = 12.3 Hz, CHNH). (2Z, 2'E): 1.38 (3H, t, JCH₂-CH₃ = 7.1 Hz, COOCH₂CH₃), 4.32 (2H, q, JCH₂-CH₃ = 7.1 Hz, COOCH₂CH₃), 7.03 (1H, ddd, JH₃'-H₅' = 1.1 Hz, JH₄'-H₅' = 7.4 Hz, JH₅'-H₆' = 5.0 Hz, H₅'), 7.31 (1H, d, JCH-NH = 12.3 Hz, CHNH), 7.32 (1H, d, JR₁NH-CH = 12.8 Hz, R₁NHC₃H), 7.47 (1H, ddd, JH₃'-H₄' = 8.2 Hz, JH₃'-H₅' = 1.1 Hz, JH₃'-H₆' = 1.0 Hz, H₃'), 7.68 (1H, ddd, JH₃'-H₄' = 8.2 Hz, JH₄'-H₅' = 7.4 Hz, JH₄'-H₆' = 1.8 Hz, H₄'), 8.42 (1H, ddd, JH₃'-H₆' = 1.0 Hz, JH₄'-H₆' = 1.8 Hz, JH₅'-H₆' = 5.0 Hz, H₆'), 9.61 (1H, d, JR₁NH-CH = 12.8 Hz, R₁NHC₃H), 11.75 (1H, d, JCH-NH = 12.3 Hz, CHNH). Anal. Caled for C₁₉H₁₇N₄O₂Br: C, 55.22; H, 4.15; N, 13.56. Found: C, 55.60; H, 4.21; N, 13.59.

Ethyl (E)-2-[((E)-2-Cyano-2-(2-pyridinyl)ethenyl)amino-3-(3-nitrophenyl)aminopropenoate and (Z)-2-[((E)- Isomer (40)]. These compounds were prepared from compound (3) (143 mg, 0.5 mmol) and 3-nitroaniline (25) (69 mg, 0.5 mmol) in 1:1 ratio, 24 h, 45% yield (85 mg), mp 192-195°C (from ethanol), IR 2190 cm⁻¹ (CN), ¹H NMR (CDCl₃) δ: (2E, 2'E): 1.34 (3H, t, JCH₂-CH₃ = 7.1 Hz, COOCH₂CH₃), 4.30 (2H, q, JCH₂-CH₃ = 7.1 Hz, COOCH₂CH₃), 7.00 (1H, d, JR₁NH-CH = 12.8 Hz, R₁NHC₃H), 7.08 (1H, ddd, JH₃'-H₅' = 1.1 Hz, JH₄'-H₃' = 7.4 Hz, JH₅'-H₆' = 5.0 Hz, H₃'), 7.27-7.35 (1H, m, 1H(Ph)), 7.32 (1H, d, JCH-NH = 12.4 Hz, CHNH), 7.46-7.53 (1H, m, 1H(Ph)), 7.49 (1H, ddd, JH₃'-H₄' = 8.2 Hz, JH₃'-H₅' = 1.1 Hz, JH₃'-H₆' = 1.0 Hz, H₃'), 7.70 (1H, ddd, JH₃'-H₄' = 8.2 Hz, JH₄'-H₃' = 7.4 Hz, JH₄'-H₆' = 1.9 Hz, H₄'), 7.83-7.90 (2H, m, 2H(Ph)), 7.86 (1H, d, JR₁NH-CH = 12.8 Hz, R₁NHC₃H), 8.46 (1H, ddd, JH₃'-H₆' = 1.0 Hz, JH₄'-H₆' = 1.9 Hz, JH₅'-H₆' = 5.0 Hz, H₆'), 11.37 (1H, d, JCH-NH = 12.4 Hz, CHNH). (2Z, 2'E): 1.40 (3H, t, JCH₂-CH₃ = 7.1 Hz, COOCH₂CH₃), 4.35 (2H, q, JCH₂-CH₃ = 7.1 Hz, COOCH₂CH₃), 7.06 (1H, ddd, JH₃'-H₅' = 1.1 Hz, JH₄'-H₃' = 7.4 Hz, JH₅'-H₆' = 5.0 Hz, H₃'), 7.38 (1H, d, JCH-NH = 12.4 Hz, CHNH), 7.69 (1H, ddd, JH₃'-H₄' = 8.2 Hz, JH₄'- H₃' = 7.4 Hz, JH₄'-H₆' = 1.9 Hz, H₄'), 7.84 (1H, d, JR₁NH-CH = 12.8 Hz, R₁NHC₃H), 8.43 (1H, ddd, JH₃'-H₆' = 1.0 Hz, JH₄'-H₆' = 1.9 Hz, JH₅'-H₆' = 5.0 Hz, H₆'), 9.84 (1H, d, JR₁NH-CH = 12.8 Hz, R₁NHC₃H), 11.85 (1H, d, JCH-NH = 12.4 Hz, CHNH). Anal. Caled for C₁₉H₁₇N₅O₄: C, 55.22; H, 4.15; N, 13.56. Found: C, 59.83; H, 4.59; N, 18.07.
General Procedure for the Preparation of β-Heteroarylamino-α,β-didehydro-α-amino Acid Derivatives (41-43):

To compound (2) (136 mg, 0.5 mmol) or (3) (143 mg, 0.5 mmol) the corresponding heteroarylamines (26, 27) (0.5 mmol) and acetic acid (2 mL) were added and the mixture was stirred at rt for several days. The volatile compounds were evaporated in vacuo, ethanol (3 mL) was added and the precipitate was collected by filtration.

Methyl (E)-2-[{(E)-2-Cyano-2-(2-pyridinyl)ethenyl}amino]-3-(5-chloro-2-pyridinyl)aminopropenoate (41). This compound was prepared from compound (2) (136 mg, 0.5 mmol) and 2-amino-5-chloropyridine (26) (64 mg, 0.5 mmol), 24 h, 83% yield (148 mg), mp 225-227°C (from ethanol), IR 2180 cm⁻¹ (CN), ¹H NMR (CDCl₃) δ: 3.80 (3H, s, COOMe), 6.78 (1H, dd, J₃-H₄ = 8.7 Hz, J₃-H₆ = 0.7 Hz, H₃(Ar)), 7.07 (1H, ddd, J₉₃-H₅₇ = 1.1 Hz, J₄₄-H₆ = 7.4 Hz, J₅₅-H₆ = 5.0 Hz, H₅'), 7.15 (1H, d, J₁₁₁₁NH-CH = 12.5 Hz, R₁₁₁₁NHCH), 7.33 (1H, d, J₁₁₁₁CH-NH = 10.3 Hz, CHNH), 7.50 (1H, ddd, J₁₁₁₁H₄ = 8.2 Hz, J₁₁₁₁H₅ = 1.1 Hz, J₁₁₁₁H₆ = 1.0 Hz, H₃'), 7.59 (1H, dd, J₁₁₁₁H₃ = 8.7 Hz, J₁₁₁₁H₄ = 2.5 Hz, H₄₁₁₁(Ar)), 7.71 (1H, ddd, J₁₁₁₁H₄ = 8.2 Hz, J₁₁₁₁H₅ = 7.4 Hz, J₁₁₁₁H₆ = 1.9 Hz, H₄'), 8.23 (1H, ddd, J₁₁₁₁H₃ = 0.7 Hz, J₁₁₁₁H₄ = 2.5 Hz, H₆₁₁₁(Ar)), 8.32 (1H, d, J₁₁₁₁NH-CH = 12.5 Hz, R₁₁₁₁NHCH), 8.46 (1H, ddd, J₁₁₁₁H₃ = 1.0 Hz, J₁₁₁₁H₄ = 1.9 Hz, J₁₁₁₁H₅ = 5.0 Hz, H₆'), 11.36 (1H, br s, CHNH). Addition of D₂O causes the loss of d at δ = 7.15 ppm and br s at δ = 11.36 ppm; d at δ = 7.33 ppm turns to s and d at δ = 8.32 turns to s. Anal. Calcd for C₁₇H₁₄N₃O₂Cl: C, 57.39; H, 3.97; N, 19.68. Found: C, 57.06; H, 3.95; N, 19.82.

Ethyl (E)-2-[(E)-2-Cyano-2-(2-pyridinyl)ethenyl]amino]-3-(5-chloro-2-pyridinyl)aminopropenoate (42). This compound was prepared from compound (3) (143 mg, 0.5 mmol) and 2-amino-5-chloropyridine (26) (64 mg, 0.5 mmol), 24 h, 29% yield (54 mg), mp 180-184°C (from ethanol), IR 2190 cm⁻¹ (CN), ¹H NMR (CDCl₃) δ: 1.33 (3H, t, JCH₂-CH₃ = 7.1 Hz, COOCH₂CH₃), 4.28 (2H, q, JCH₂-CH₃ = 7.1 Hz, COOCH₂CH₃), 6.80 (1H, dd, J₁₁₁₁H₃ = 8.7 Hz, J₁₁₁₁H₄ = 0.7 Hz, H₃₁₁₁(Ar)), 7.05 (1H, ddd, J₁₁₁₁H₅ = 1.1 Hz, J₁₁₁₁H₆ = 7.4 Hz, J₁₁₁₁H₅ = 5.0 Hz, H₅'), 7.35 (1H, br s, CHNH), 7.37 (1H, br s, R₁₁₁₁NHCH), 7.44 (1H, ddd, J₁₁₁₁H₄ = 8.2 Hz, J₁₁₁₁H₅ = 1.1 Hz, J₁₁₁₁H₆ = 1.0 Hz, H₅'), 7.58 (1H, dd, J₁₁₁₁H₃ = 8.7 Hz, J₁₁₁₁H₄ = 2.5 Hz, H₄₁₁₁(Ar)), 7.67 (1H, ddd, J₁₁₁₁H₄ = 8.2 Hz, J₁₁₁₁H₅ = 7.4 Hz, J₁₁₁₁H₆ = 1.8 Hz, H₄'), 8.23 (1H, dd, J₁₁₁₁H₆ = 0.7 Hz, J₁₁₁₁H₆ = 2.5 Hz, H₆₁₁₁(Ar)), 8.29 (1H, d, J₁₁₁₁NH-CH = 12.7 Hz, R₁₁₁₁NHCH), 8.45 (1H, ddd, J₁₁₁₁H₃ = 1.0 Hz, J₁₁₁₁H₄ = 1.8 Hz, J₁₁₁₁H₅ = 5.0 Hz, H₆'), 11.33 (1H, br s, CHNH). Addition of D₂O causes the loss of br s at δ = 7.37 ppm and br s at δ = 11.33 ppm; br s at δ = 7.35 ppm turns to s and d at δ = 8.29 turns to s. Anal. Calcd for C₁₈H₁₆N₅O₂Cl: C, 58.46; H, 4.36; N, 18.94. Found: C, 58.18; H, 4.04; N, 19.03.
Methyl (E)-2-[(E)-2-Cyano-2-(pyridinyl)ethenyl]amino-3-(isoxazolyl)aminopropanoate and (Z)-2-[(E)-Isomer (43)]. These compounds were prepared from compound (2) (136 mg, 0.5 mmol) and 3-aminoisoxazol (27) (48 mg, 0.5 mmol) in 3:2 ratio, 7 days, 80% yield (125 mg), mp 181-184°C (from ethanol), IR 2190 cm⁻¹ (CN), ¹H NMR (CDCl₃) δ: (2E, 2'E): 3.81 (3H, s, COOMe), 6.12 (1H, d, J₉₄·₉₅ = 1.8 Hz, H₄(Ar)), 6.95 (1H, d, J₉₁₈·₉₂ = 12.4 Hz, R₁NHCH), 7.08 (1H, ddd, J₉₃·₉₄ = 1.1 Hz, J₉₄·₉₅ = 7.5 Hz, J₉₅·₆₆ = 5.0 Hz, H₅), 7.28 (1H, d, J₉₁₈·₉₂ = 11.5 Hz, CHNH), 7.51 (1H, ddd, J₉₃·₉₄ = 8.1 Hz, J₉₅·₆₆ = 1.1 Hz, J₉₅·₆₆ = 1.0 Hz, H₅), 7.72 (1H, ddd, J₉₃·₉₄ = 8.1 Hz, J₉₄·₉₅ = 7.5 Hz, J₉₄·₆₆ = 1.8 Hz, H₄), 7.82 (1H, d, J₉₁₈·₉₂ = 12.4 Hz, R₁NHCH), 8.27 (1H, d, J₉₄·₆₆ = 1.8 Hz, H₅(Ar)), 8.43 (1H, ddd, J₉₅·₆₆ = 1.0 Hz, J₉₄·₆₆ = 1.8 Hz, J₉₅·₆₆ = 5.0 Hz, H₆), 11.35 (1H, d, J₉₁₈·₉₂ = 11.5 Hz, CHNH). Addition of D₂O causes the loss of d at δ = 6.95 ppm and d at δ = 11.35 ppm; d at δ = 7.28 ppm turns to s and d at δ = 7.82 turns to s. (2Z, 2'E): 3.89 (3H, s, COOME), 6.21 (1H, d, J₉₄·₉₅ = 1.8 Hz, H₄(Ar)), 7.05 (1H, ddd, J₉₃·₉₄ = 1.1 Hz, J₉₄·₉₅ = 7.5 Hz, J₉₅·₆₆ = 5.0 Hz, H₅), 7.30 (1H, d, J₉₁₈·₉₂ = 11.5 Hz, CHNH), 7.48 (1H, ddd, J₉₃·₉₄ = 8.1 Hz, J₉₅·₆₆ = 1.1 Hz, J₉₅·₆₆ = 1.0 Hz, H₅), 7.49 (1H, d, J₉₁₈·₉₂ = 12.4 Hz, R₁NHCH), 7.69 (1H, ddd, J₉₃·₉₄ = 8.1 Hz, J₉₄·₆₆ = 7.5 Hz, J₉₄·₆₆ = 1.8 Hz, H₄), 8.25 (1H, d, J₉₄·₆₆ = 1.8 Hz, H₅(Ar)), 8.45 (1H, ddd, J₉₃·₆₆ = 1.0 Hz, J₉₄·₆₆ = 1.8 Hz, J₉₅·₆₆ = 5.0 Hz, H₆), 9.47 (1H, d, J₉₁₈·₉₂ = 12.4 Hz, R₁NHCH), 11.71 (1H, d, J₉₁₈·₉₂ = 11.5 Hz, CHNH). Addition of D₂O causes the loss of d at δ = 9.47 ppm and d at δ = 11.71 ppm; d at δ = 7.30 ppm turns to s. Anal. Caled for C₁₅H₁₃N₅O₃: C, 57.88; H, 4.21; N, 22.50. Found: C, 57.63; H, 4.27; N, 22.26.

**General Procedure for the Preparation of Pyrido[1,2-α]pyrimidin-4-ones (50-53), Thiazolo[3,2-α]pyrimidin-4-one (54) and Benzothiazolo[3,2-α]pyrimidin-4-one (55):**

To compound (2) (136 mg, 0.5 mmol) or (3) (143 mg, 0.5 mmol) the corresponding heteroarylamine (26, 44-48) (0.5 mmol) and acetic acid (2 mL) were added and the reaction mixture was heated under reflux for 1 to 1.5 h. The volatile compounds were evaporated in vacuo, ethanol (3 mL) was added, the precipitate was collected by filtration and washed with ethanol.

3-[2-Cyano-2-(pyridinyl)ethenyl]amino-7-chloro-4H-pyrido[1,2-α]pyrimidin-4-one (50). This compound was prepared from compound (2) (136 mg, 0.5 mmol) and 2-amino-5-chloropyridine (26) (64 mg, 0.5 mmol), 1 h, 42% yield (68 mg), and from compound (3) (143 mg, 0.5 mmol) and 2-amino-5-chloropyridine (26) (64 mg, 0.5 mmol), 1.5 h, 13% yield (21 mg), mp 286-288°C (from ethanol), IR 2180 cm⁻¹ (CN), ¹H NMR (CDCl₃) δ: 7.16 (1H, ddd, J₉₃·₉₄ = 1.1 Hz, J₉₄·₉₅ = 7.5 Hz, J₉₅·₆₆ = 5.0 Hz, H₅), 7.52 (1H, dd, J₉₆·₉₈ = 2.3 Hz, J₉₈·₉₉ = 9.5 Hz, H₉₈), 7.58 (1H, ddd, J₉₃·₉₄ = 8.2 Hz, J₉₃·₉₄ = 1.1 Hz, J₉₃·₉₄ =
= 1.0 Hz, H3'), 7.61 (1H, dd, JH6-H9 = 0.8 Hz, JH8-H9 = 9.5 Hz, H9), 7.76 (1H, ddd, JH3-H4 = 8.2 Hz, JH4-H5 = 7.5 Hz, JH4-H6 = 1.9 Hz, Ha'), 7.91 (1H, d, JCH-NH = 12.0 Hz, CHN), 8.33 (1H, s, H2), 8.66 (1H, ddd, JH3-H6 = 1.0 Hz, JH4-H6 = 1.9 Hz, JH5-H6 = 5.0 Hz, Hb'), 9.02 (1H, dd, JH6-H8 = 2.3 Hz, JH6-H9 = 0.8 Hz, H6), 12.96 (1H, d, JCH-NH = 12.0 Hz, CHN). Anal. Calcd for C16H11N3O: C, 59.36; H, 3.11; N, 21.63. Found: C, 59.43; H, 2.99; N, 21.74.

3-[2-Cyano-2-(2-pyridinyl)ethenyl]amino-4H-pyrido[1,2-a]pyrimidin-4-one (51). This compound was prepared from compound (2) (136 mg, 0.5 mmol) and 2-aminopyridine (44) (47 mg, 0.5 mmol), 1.5 h, 18% yield (26 mg), and from compound (3) (143 mg, 0.5 mmol) and 2-aminopyridine (44) (47 mg, 0.5 mmol), 1.5 h, 16% yield (23 mg), mp 275-276°C (from ethanol), IR 2220 cm⁻¹ (CN), ¹H NMR (CDCl₃) δ: 7.14 (1H, ddd, JH3-H5 = 1.1 Hz, JH4-H5 = 7.4 Hz, JH5-H6 = 5.0 Hz, H3), 7.16 (1H, ddd, JH6-H7 = 7.3 Hz, JH7-H8 = 6.3 Hz, JH7-H9 = 1.7 Hz, H7), 7.57 (1H, ddd, JH3-H4 = 8.2 Hz, JH4-H5 = 1.1 Hz, JH4-H6 = 1.0 Hz, H4), 7.61 (1H, ddd, JH6-H8 = 1.5 Hz, JH7-H8 = 6.3 Hz, JH7-H9 = 1.7 Hz, JH8-H9 = 9.0 Hz, H8), 7.67 (1H, ddd, JH6-H9 = 0.9 Hz, JH7-H9 = 1.7 Hz, JH8-H9 = 9.0 Hz, H9), 7.75 (1H, ddd, JH3-H4 = 8.2 Hz, JH4-H5 = 7.4 Hz, JH4-H6 = 1.9 Hz, H4), 7.93 (1H, d, JCH-NH = 13.0 Hz, CHN), 8.37 (1H, s, H2), 8.66 (1H, ddd, JH3-H6 = 1.0 Hz, JH4-H6 = 1.9 Hz, JH5-H6 = 5.0 Hz, H5), 9.01 (1H, ddd, JH6-H7 = 7.3 Hz, JH6-H8 = 1.5 Hz, JH6-H9 = 0.9 Hz, H6), 12.88 (1H, d, JCH-NH = 13.0 Hz, CHN). Anal. Calcd for C₁₅H₁₁N₅O: C, 66.43; H, 3.83; N, 24.21. Found: C, 66.23; H, 3.68; N, 24.22.

3-[2-Cyano-2-(2-pyridinyl)ethenyl]amino-8-methyl-4H-pyrido[1,2-a]pyrimidin-4-one (52). This compound was prepared from compound (2) (136 mg, 0.5 mmol) and 2-aminomethylpyridine (45) (54 mg, 0.5 mmol), 1.5 h, 19% yield (29 mg), and from compound (3) (143 mg, 0.5 mmol) and 2-aminomethylpyridine (45) (54 mg, 0.5 mmol), 1.5 h, 11% yield (17 mg), mp 283-285°C (from ethanol), IR 2210 cm⁻¹ (CN), ¹H NMR (CDCl₃) δ: 2.49 (3H, d, J8-Me-H9 = 1.2 Hz, 8-Me), 7.00 (1H, dd, JH6-H7 = 7.4 Hz, JH7-H9 = 2.0 Hz, H7), 7.12 (1H, ddd, JH3-H5 = 1.1 Hz, JH4-H5 = 7.5 Hz, JH5-H6 = 5.0 Hz, H3), 7.44 (1H, ddq, JH6-H9 = 0.9 Hz, JH7-H9 = 2.0 Hz, J8-Me-H9 = 1.2 Hz, H8), 7.56 (1H, ddd, JH3-H4 = 8.2 Hz, JH3-H5 = 1.1 Hz, JH3-H6 = 1.0 Hz, H3), 7.74 (1H, ddd, JH3-H4 = 8.2 Hz, JH4-H5 = 7.5 Hz, JH4-H6 = 1.8 Hz, H4), 7.91 (1H, d, JCH-NH = 12.3 Hz, CHN), 8.32 (1H, s, H2), 8.64 (1H, ddd, JH3-H6 = 1.0 Hz, JH4-H6 = 1.8 Hz, JH5-H6 = 5.0 Hz, H5), 8.92 (1H, dd, JH6-H7 = 7.4 Hz, JH6-H9 = 0.9 Hz, H6), 12.81 (1H, d, JCH-NH = 12.3 Hz, CHN). Anal. Calcd for C₁₇H₁₃N₅O: C, 67.32; H, 4.32; N, 23.09. Found: C, 67.33; H, 4.31; N, 23.27.

3-[2-Cyano-2-(2-pyridinyl)ethenyl]amino-9-hydroxy-4H-pyrido[1,2-a]pyrimidin-4-one (53). This compound was prepared from compound (2) (136 mg, 0.5 mmol) and 2-amino-3-hydroxypyridine (46)
(55 mg, 0.5 mmol), 1.5 h, 15% yield (23 mg), and from compound (3) (143 mg, 0.5 mmol) and 2-amino-3-hydroxypyridine (46) (55 mg, 0.5 mmol), 1.5 h, 11% yield (17 mg), mp 279-283°C (from ethanol (decomp)), IR 2180 cm⁻¹ (CN), ¹H NMR (CDCl₃) δ: 7.06 (1H, dd, JH₆-H₈ = 2.0 Hz, JH₇-H₈ = 7.5 Hz, H₈), 7.10 (1H, dd, JH₆-H₇ = 6.5 Hz, JH₇-H₈ = 7.5 Hz, H₇), 7.15 (1H, ddd, JH₃'-H₅' = 1.1 Hz, JH₄'-H₅' = 7.4 Hz, JH₅'-H₆' = 5.0 Hz, H₅'), 7.58 (1H, ddd, JH₃'-H₃' = 8.1 Hz, JH₃'-H₅' = 1.1 Hz, JH₃'-H₆' = 1.0 Hz, H₃'), 7.76 (1H, ddd, JH₃'-H₄' = 8.1 Hz, JH₄'-H₅' = 7.4 Hz, JH₄'-H₆' = 1.8 Hz, H₄'), 7.89 (1H, d, JCH-NH = 12.3 Hz, CHNH), 8.28 (1H, s, H₂), 8.53 (1H, dd, JH₆-H₇ = 6.5 Hz, JH₆-H₈ = 2.0 Hz, H₆), 8.66 (1H, ddd, JH₃'-H₃' = 1.0 Hz, JH₄'-H₆' = 1.8 Hz, JH₅'-H₆' = 5.0 Hz, H₆'), 12.90 (1H, d, JCH-NH = 12.3 Hz, CHNH). Anal. Calcd for C₁₆H₁₁N₅O₂: C, 62.95; H, 3.63; N, 22.94. Found: C, 62.74; H, 3.44; N, 23.00.

6-[2-Cyano-2-(2-pyridinyl)ethenyl]amino-5H-thiazolo[3,2-a]pyrimidin-4-one (54). This compound was prepared from compound (2) (136 mg, 0.5 mmol) and 2-aminothiazole (47) (50 mg, 0.5 mmol), 1 h, 18% yield (27 mg), mp 297-299°C (from ethanol), IR 2180 cm⁻¹ (CN), ¹H NMR (CDCl₃) δ: 7.09 (1H, d, JH₂-H₃ = 4.9 Hz, H₂), 7.13 (1H, ddd, JH₃'-H₅' = 1.1 Hz, JH₄'-H₅' = 7.5 Hz, JH₅'-H₆' = 5.0 Hz, H₅'), 7.56 (1H, ddd, JH₃'-H₄' = 8.3 Hz, JH₃'-H₅' = 1.1 Hz, JH₃'-H₆' = 1.0 Hz, H₃'), 7.74 (1H, ddd, JH₃'-H₄' = 8.3 Hz, JH₄'-H₅' = 7.5 Hz, JH₄'-H₆' = 1.9 Hz, H₄'), 7.82 (1H, d, JCH-NH = 12.8 Hz, CHNH), 8.01 (1H, d, JH₂-H₃ = 4.9 Hz, H₃), 8.02 (1H, s, H₂), 8.62 (1H, ddd, JH₃'-H₃' = 1.0 Hz, JH₄'-H₆' = 1.9 Hz, JH₅'-H₆' = 5.0 Hz, H₆'), 12.74 (1H, d, JCH-NH = 12.8 Hz, CHNH). Anal. Calcd for C₁₄H₉N₅OS: C, 56.94; H, 3.07; N, 23.71. Found: C, 56.65; H, 3.16; N, 23.44.

3-[2-Cyano-2-(2-pyridinyl)ethenyl]amino-4H-benzothiazolo[3,2-a]pyrimidin-4-one (55). This compound was prepared from compound (2) (136 mg, 0.5 mmol) and 2-aminobenzothiazole (48) (75 mg, 0.5 mmol), 1 h, 13% yield (22 mg), mp 288-290°C (from ethanol), IR 2200 cm⁻¹ (CN), ¹H NMR (CDCl₃) δ: 7.16 (1H, ddd, JH₃'-H₅' = 1.0 Hz, JH₄'-H₅' = 8.2 Hz, JH₅'-H₆' = 5.0 Hz, H₅'), 7.53-7.59 (3H, m, H₃', 2H(Ph)), 7.69-7.79 (2H, m, H₄', 1H(Ph)), 7.77 (1H, d, JCH-NH = 11.6 Hz, CHNH), 7.93 (1H, s, H₂), 8.69 (1H, ddd, JH₃'-H₆' = 0.8 Hz, JH₄'-H₆' = 1.8 Hz, JH₅'-H₆' = 5.0 Hz, H₆'), 9.12-9.15 (1H, m, 1H(Ph)), 12.79 (1H, d, JCH-NH = 11.6 Hz, CHNH). Anal. Calcd for C₁₈H₁₁N₅O₂: C, 62.60; H, 3.21; N, 20.28. Found: C, 62.43; H, 3.31; N, 20.04.

Methyl 1-(5-Methyl-3-isoxazolyl)-1H-imidazole-4-carboxylate (56). To compound (2) (136 mg, 0.5 mmol) 3-amino-5-methylisoxazole (49) (50 mg, 0.5 mmol) and acetic acid (2 mL) were added and the reaction mixture was heated under reflux for 5 h. The volatile compounds were evaporated in vacuo and ethanol (3 mL) was added to precipitate 56 in 20% yield (21 mg), mp 197-198°C (from ethanol), ¹H NMR
(CDCl₃) δ: 2.53 (3H, d, J₄'₅-Me = 0.9 Hz, 5'-Me), 3.94 (3H, s, COOMe), 6.23 (1H, q, J₄₅-Me = 0.9 Hz, H₄'), 8.02 (1H, d, J₄₅-H₅ = 1.4 Hz, H₅), 8.05 (1H, d, J₄₅-H₅ = 1.4 Hz, H₂). Anal. Calcd for C₉H₉N₃O₃: C, 52.17; H, 4.38; N, 20.28. Found: C, 63.69; H, 6.02; N, 14.00.

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