# Reactions with 2(1*H*)-Quinolinone and Coumarine Derivatives: New Routes to Polysubstituted 2(1*H*)-Quinolinone and Coumarine Derivatives

**Fathy Mohamed Abdel Aziz El-Taweel,* Salah Zaki Ahmed Sowellim, and Abdel Ghani Ali Elagamey**

Department of Chemistry, Faculty of Science, New Damietta University, A. R. Egypt

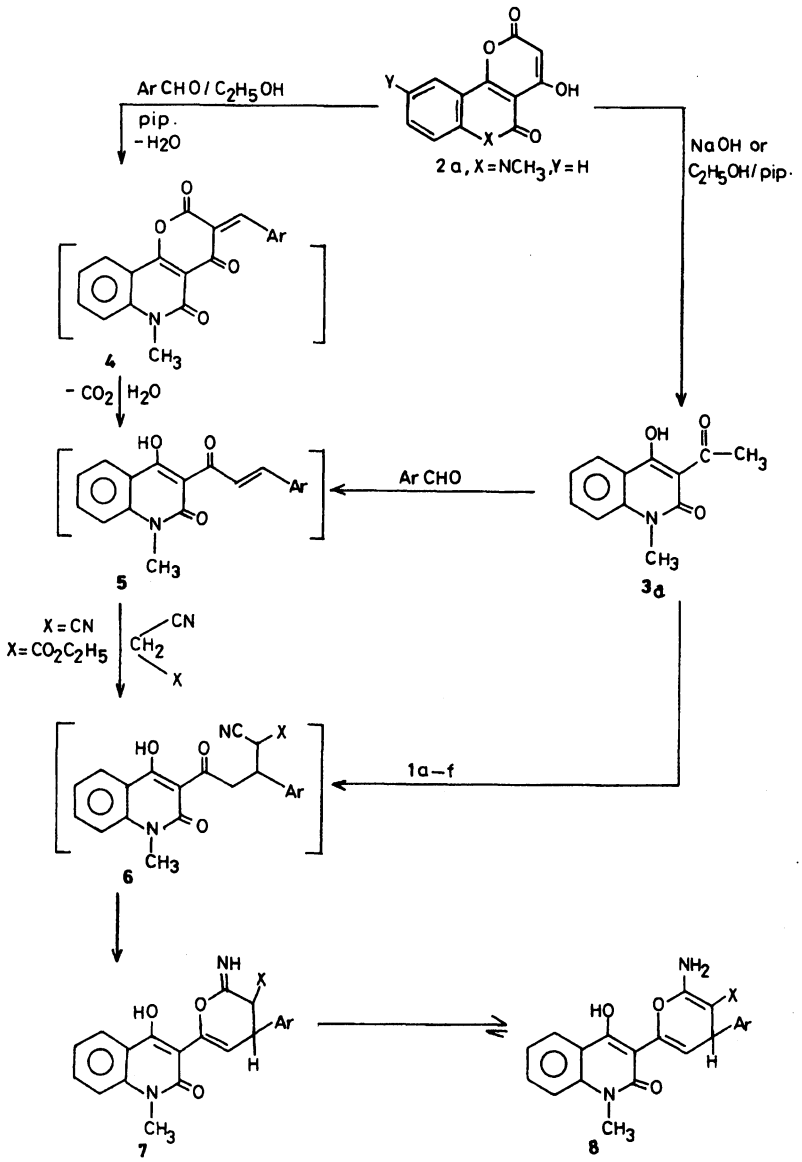
(Received May 16, 1994)

Whereas 2*H*- pyrano[3,2-*c*]quinoline-2,5(6*H*)-dione (**2a**) or 3-acetyl-1-methyl-2(1*H*)-quinolinone (**3a**) reacted with the benzylidenenitriles **1a**—**f** or a mixture of either malononitrile or ethyl cyanoacetate and aromatic aldehydes in ethanol/piperidine to give 4*H*-pyran derivatives **8**, the reaction of **2b,c** or **3b,c** with the same reagents afforded 4,6-dihydro-5*H*-pyrano[3,2-*c*]quinolin-5-ones **11**. Compounds **11** were also prepared from **1a**—**f** and **3d,e,f**. Reaction of pyrano[3,2-*c*]coumarin **2d** with **1a** yielded 6*H*,11*H*-[2]benzopyrano[4,3-*c*]-[1]benzopyran-6,11-dione (**15**). Treatment of **17** with aqueous potassium cyanide or hydroxylamine afforded the 2(1*H*)-quinolinone derivatives **19** and **20** respectively.

Polysubstituted quinolines and coumarines are interesting as potential biodegradable agrochemicals,[1,2] effective as antischistosomal agents,[2] antibacterials,[3,4] antimalarials,[5] antimicrobials,[6] and antiamoebics.[2] They are also useful intermediates in the manufacture of azo dyestuffs. These azo dyes are used for dyeing both synthetic and naturally occuring fibres.[7,8] Although, a large number of substituted derivatives of the above mentioned biologically interesting 2(1*H*)-quinolinones and coumarins have been prepared, no simple general route for derivatives of these compounds are available. As a part of our programme directed for developing simple and efficient procedures for synthesis of functionally substituted $\pi$-deficient heterocycles as potential biodegradable agrochemicals and antischistosomal agents.[1,2,9,10] We report here new access for synthesis of several new 2(1*H*)-quinolinone and coumarin derivatives using readily obtainable starting materials. Also, in the present work, the nature of the end products was found to be dependent on the nature of the utilized reactants.

In recent publication, we have found that,[9] 3-acetyl-1-methyl-4-hydroxy-2(1*H*)-quinolinone (**3a**), prepared by alkaline hydrolysis of pyrano[3,2-*c*]quinoline **2a**,[1] reacted with the benzylidenenitriles **1a**—**f** in ethanol/piperidine to give the 4*H*-pyran derivatives **8a**—**f** (Chart 1).[9] Compounds **8** were proposed to be formed via Michael type addition of the methyl function in **3a** to the activated double bond in **1** to yield the acyclic adduct **6** which then cyclized into **8**. $^1$H NMR spectra of **8** clearly indicated the absence of methyl function which was taken as an evidence for the involvement of the acetyl group in the reaction. It is necessary to state that the aromatic OH function in **3a** was not involved in the reaction, in contrast to the recently reported high reactivity of the phenolic OH groups toward **1**.[9] This may be attributed to the involvement of the OH function in **3a** in the hydrogen bonding. In this work, we have found that, the pyrans **8a**—**f**, were prepred by a modified method, from 2*H*-pyrano[3,2-*c*]quinoline-2,5(6*H*)-dione (**2a**) directly and **1a**—**f** or from a mixture of **2a**, aromatic aldehydes and activated nitriles. Formation of **8** from **2a** and **1** is assumed to be formed via intermediacy of **5** which then reacted further with malononitrile or ethyl cyanoacetate to give the final isolable product **8**. As a support for this mechanism, **5** was prepared from **2a** and aromatic aldehydes. Structure of **5** was established by comparison with authentic samples prepared from **3a** and aromatic aldehydes (cf. Scheme 1).

In contrary to the behavior of **2a** or **3a** towards cinnamonitriles **1**, the reaction of 2*H*-pyrano[3,2-*c*]quinoline-2,5(6*H*)-diones (**2b,c**) with **1a**—**f** or a mixture of malononitrile or ethyl cyanoacetate and aromatic aldehydes afforded 4,6-dihydro-5*H*pyrano[3,2-*c*]quinolin-5-ones (**11**). Structure **11** was established on the basis of $^1$H NMR spectra which displayed the 4*H*-pyran protons at $\delta$=4.5 ppm. Formation of **11** from **2b,c** and **1** is assumed to proceed via initial hydrolysis[11] of **2b, c** under the reaction conditions to give **3b,c**. Compounds **3b,c** were added to the $\pi$-deficient double bond in **1** to form the adducts **9** which then converted into **10** via deacetylation as has been previously reported.[11—15]

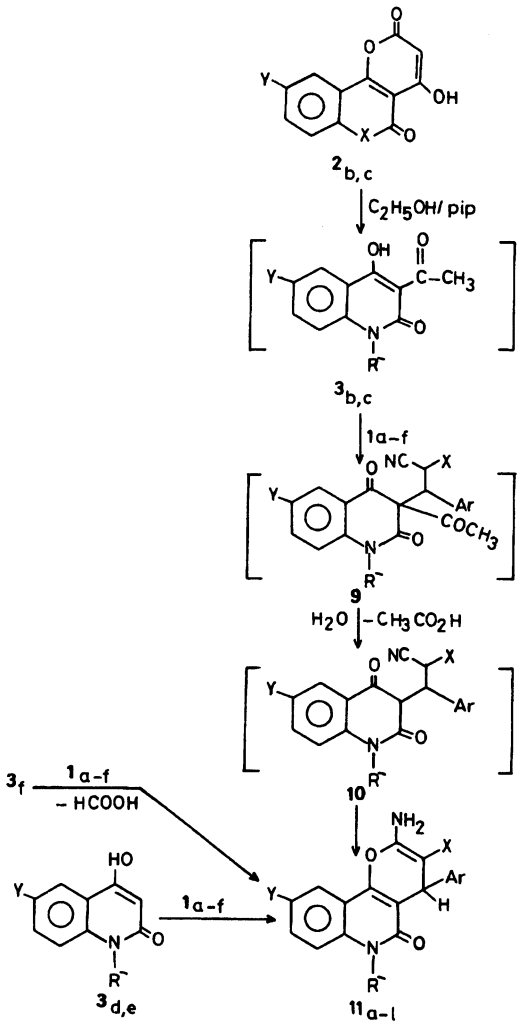



Scheme 1.

The intermediates **10** were cyclized to give the 4,6-dihydro-5*H*-pyrano[3,2-*c*]quinolin-5-ones **11a**—**l**(Scheme 2). This mechanism finds support by the formation of **11** from reaction of **3b,c,f** with the same reagents.[1] It is interesting to note that, the formation of **11** from 3-acetyl-2(1*H*)-quinolinones (**3b,c**) and **1** is proceeded by addition of the quinolinyl C-3 to the activated double bond in **1**. Compounds **3b,c** may be existing as 4-quinolones,[16,17] at which quinoline 3-position becomes more acidic than its acetyl group. Moreover, the steric effect in the intermediate **9** facilitate deacetylation process.

On the other hand, treatment of 2*H*,5*H*-pyrano-[3,2-*c*][1]benzopyran-2,5-dione (**2d**) with benzylidenemalononitrile (**1a**) in a molar ratio 1 : 1 or 1 : 2 in ethanol containing few drops of piperidine yielded product of molecular formula $C_{24}H_{11}N_3O_4$ ($M^+=405$). Thus, structure **16** was completely excluded. IR spectrum of the reaction product showed absorption bands at $\nu=3500$—$3200$ cm$^{-1}$ for $NH_2$, 2215 cm$^{-1}$ for CN, and 1685 cm$^{-1}$ for CO group. $^1$H NMR spectrum of **15** revealed the aromatic and $NH_2$ protons. Consequently, structure **15** was assigned as a reaction product. Compound **15** is assumed to be obtained via condensation of 2*H*,5*H*-pyrano[3,2-*c*][1]benzopyran-2,5-dione (**2d**) with malononitrile, formed in situ by hydrolysis of **1a**,[18] to give the dicyanomethylene derivative **12**. Compound **12** is then added further to another molecule of **1a** to give **13** which cyclized into the intermediate **14**. Dehydrocyanation of **14** affords **15**. Similar reactions have been previously reported for construction of aromatic rings on a $\pi$-deficient heterocycles[1,10] (cf. Scheme 3).

Refluxing a mixture of **3b** and *N*-bromosuccinimide in carbon tetrachloride furnishs 3-bromoacetyl-4-hydroxy-1-ethyl-2(1*H*)-quinolinone (**17**). Compound **17** reacts with aqueous potassium cyanide to give **19** via the intermediate **18**. Reaction of **19** with **1a**—**f** afforded also **11** via deacetylation (cf. Scheme 4). Condensation of



Scheme 2.

**3b** with hydroxylamine hydrochloride in methanol and in presence of sodium acetate as catalyst, gave the oxime **20**. Attempts to cyclize this oxime **20** into the isoxazolo[4,5-*c*]quinolin-4(5*H*)-one **21** in refluxing benzene or toluene catalyzed by *p*-toluene sulfonic acid failed.

## Experimental

All melting points are uncorrected. IR spectra were determined on a Pye-Unicam SP1000 instrument. $^1$H NMR spectra were determined on an EM 390 90 MHz spectrometer in DMSO-$d_6$ solution are expressed in $\delta$ ppm. Mass spectra were recorded on MS 30 or MS 9 (AEI) mass spectrometers operating at 70 eV. UV spectra were recoded on Perkin–Elmer Lambda 2 UV-vis spectrometer (270—600 nm). Microanalysis were carried out by the Microanlytical Data Unit at Cairo and El-Mansoura Universities.

**Preparation of 4*H*-Pyran Derivatives 8. Method A:** A suspension of **2a** (0.01 mol) in ethanol (50 ml) containing piperidine (0.5 ml) was treated with **1a—f** (0.01 mol). The reaction mixture was refluxed for 1 h. The solid products so, obtaind, were filtered off, crystallized and identified as **8**.

**Method B:** Compounds **8** were also prepared from **2a**, malononitrile or ethyl cyanoacetate and aromatic aldehydes. The products obtained were identified (mp, mixed mp, IR, and MS) with the products prepared by us by reacting **3a** with **1a—f**[9] using the same previous treatment.

**Method C:** Equimolar amounts of **5** and malononitrile or ethyl cyanoacetate yielded also **8**.

**Formation of 11a—l and 15. General Procedure: Method A:** A mixture of **2b,c** or **2d** (0.01 mol) and **1** (0.01 mol) containing few drops of piperidine was refluxed for half an hour, then left to cool. The obtained precipitates were recrystallized from ethanol/DMF and then identified as **11a—l** and **15** respectively.

**Method B:** Refluxing of **3b** or **3c** (0.01 mol) and of **1a—f** (0.01 mol) using the same previous procedure, afforded **11a—l**.

**Method C:** Compounds **11** were also prepared from **3d** or **3e** (0.01 mol) and **1a—f** (0.01 mol) utilizing the above reaction conditions.

**Method D:** Heating **3f** (0.01 mol) in ethanol (30 ml) containing two drops of piperidine and **1a—f** (0.01 mol), afforded **11**.

**Method E:** Equimolar amounts of **19** and **1a—f** using the above procedure yielded **11**.

**2-Amino-5,6-dihydro-6-ethyl-5-oxo-4-phenyl-4*H*-pyrano[3,2-*c*]quinoline-3-carbonitrile (11a).** Pale yellow crystals, yield 75%; mp 238 °C. IR 3400, 3335, 3215 ($NH_2$), 2210 (CN), 1685 (CO), 1640 cm$^{-1}$ ($NH_2$). $^1$H NMR (DMSO-$d_6$) $\delta$=1.05—1.20 (t, $J$=7 Hz, 3H, $CH_3$), 4.05—4.30 (q, $J$=7 Hz, 2H, $CH_2$), 4.55 (s, 1H, pyran 4-H), 7.10—8.10 (m, 11H, aromatic protons and $NH_2$ protons). MS $m/z$ 343 (66.3%, $M^+$), 266 (100%), 238 (38.5%), 102 (5.7%). Found: C, 73.51; H, 5.11; N, 12.20%. Calcd for $C_{21}H_{17}N_3O_2$: C, 73.46; H, 4.99; N, 12.24%.

**2-Amino-5,6-dihydro-6-ethyl-4-(4-methoxyphenyl)-5-oxo-4*H*-pyrano[3,2-*c*]quinoline-3-carbonitrile (11b).** Yellowish crystals, yield 78%; mp 260 °C. IR 3375, 3320, 3200 ($NH_2$), 2215 (CN), 1685 (CO), 1635 cm$^{-1}$ ($\delta NH_2$). $^1$H NMR (DMSO-$d_6$) $\delta$=1.06—1.12 (t, $J$=7 Hz, 3H, $CH_3$), 3.6 (s, 3H, $OCH_3$), 4.06—4.17 (q, $J$=7 Hz, 2H, $CH_2$), 4.5 (s, 1H, pyran 4-H), 6.67—7.09 (dd, $J$=9 Hz, 4H, aromatic protons), 7.14 (s, 2H, $NH_2$), 7.20—8.06 (m, 4H, aromatic protons). MS $m/z$ 373 (70.3, $M^+$), 266 (100%), 238 (45%). Found: C, 70.34; H, 5.22; N, 12.51%. Calcd for $C_{22}H_{19}N_3O_3$: C, 70.76; H, 5.13; N, 12.25%.

**2-Amino-4-(4-chlorophenyl)-5,6-dihydro-6-ethyl-5-oxo-4*H*-pyrano[3,2-*c*]quinoline-3-carbonitrile (11c)** Yellow crystals, yield 70%; mp 278 °C. IR 3350, 3300, 3190 ($NH_2$), 2198 (CN), 1678 (CO), 1620 cm$^{-1}$ ($\delta NH_2$). $^1$H NMR (DMSO-$d_6$) $\delta$=1.05—1.12 (t, $J$=7 Hz, 3H, $CH_3$), 4.06—4.18 (q, $J$=7 Hz, $CH_2$), 4.56 (s, 1H, pyran 4-H), 7.21—8.08 (m, 10H, aromatic protons and $NH_2$ protons). UV-vis $\lambda_{max}$ [nm] (DMF) 280, 332, 350, 400. Found: C, 66.80; H, 4.52; N, 11.34%. Calcd for $C_{21}H_{16}ClN_3O_2$: C, 66.76; H, 4.27; N, 11.12%.

**2-Amino-9-chloro-5,6-dihydro-5-oxo-4-phenyl-4*H*-pyrano[3,2-*c*]quinoline-3-carbonitrile (11d).** Colorless crystals, yield 65%; mp>300°C. IR 3470, 3365, 3195 ($NH_2$, NH), 2205 (CN), 1668 (CO), 1650 cm$^{-1}$ ($\delta NH_2$). $^1$H NMR (DMSO-$d_6$) $\delta$=4.50 (s, 1H, pyran 4-H), 7.15—7.65 (m, 1OH, aromatic protons and $NH_2$ protons), 7.95 (s, 1H, NH). Found: C, 65.46; H, 3.36; N, 12.11%. Calcd for $C_{19}H_{12}ClN_3O_2$: C, 65.32; H, 3.46; N, 12.03%.

**2-Amino-9-chloro-5,6-dihydro-4-(4-methoxyphen-**

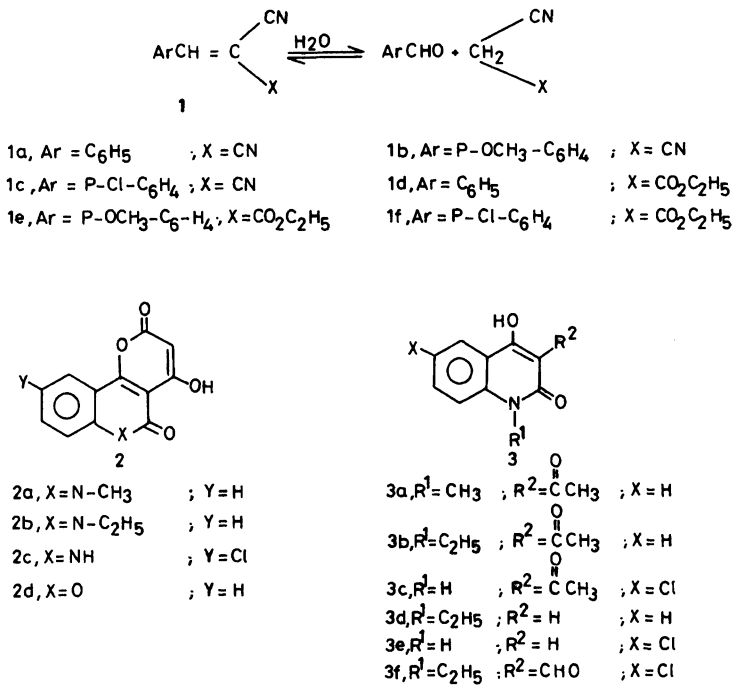
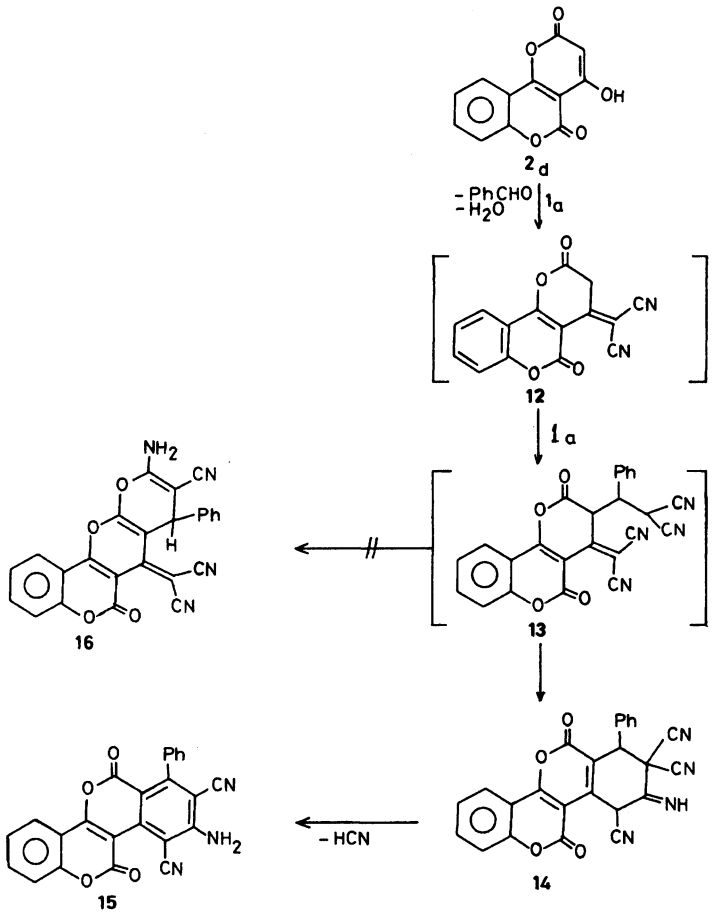
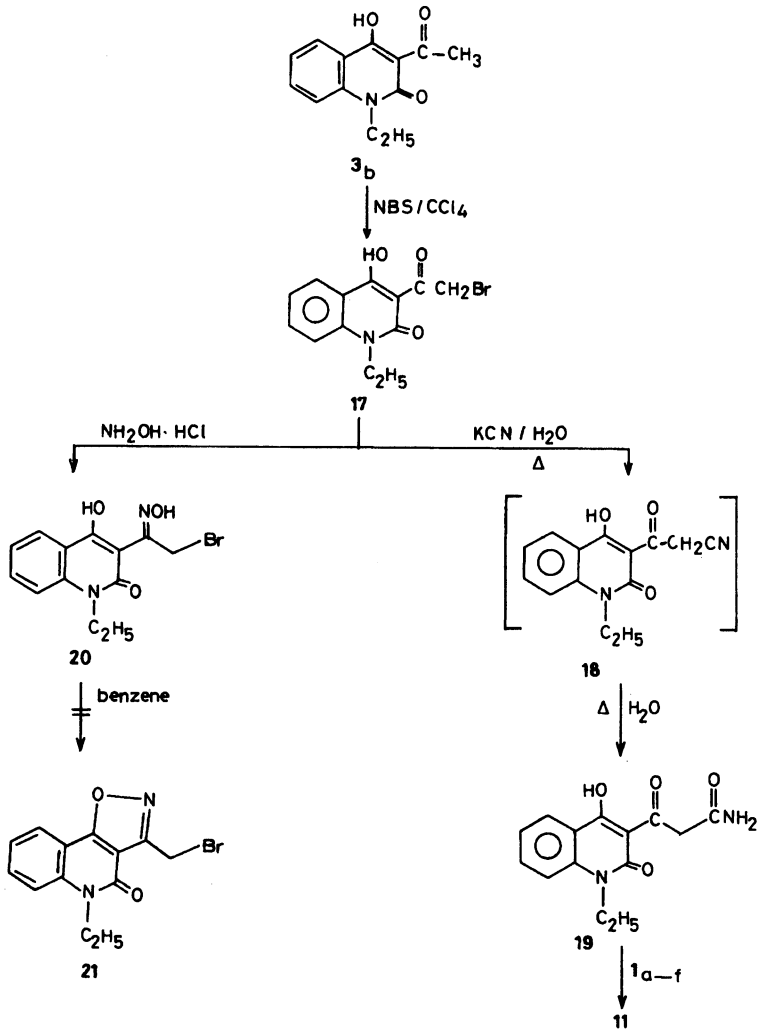


Chart 1.



Scheme 3.

**yl)-5-oxo-4*H*-pyrano[3,2-c]quinoline-3-carbonitrile (11e).** Colorless crystals, yield 65%; mp>300°C. IR 3450, 3320 ($NH_2$, NH), 2205 (CN), 1678 (CO), 1645 $cm^{-1}$ ($\delta NH_2$). $^1H$ NMR (DMSO-$d_6$) $\delta$=3.62 (s, 3H, $OCH_3$), 4.38 (s, 1H, pyran 4-H), 6.71—7.12 (dd, $J$=9 Hz, 4H, aromatic protons), 7.19 (s, 2H, $NH_2$), 7.29—7.94 (m, 3H, aromatic




Scheme 4.

protons), 11.54 (s, 1H, NH). Found: C, 63.53; H, 3.43; N, 11.21%. Calcd for $C_{20}H_{14}ClN_3O_3$: C, 63.25; H, 3.72; N, 11.06%.

**2-Amino-9-chloro-4-(4-chlorophenyl)-5,6-dihydro-5-oxo-4*H*-pyrano[3,2-*c*]quinoline-3-carbonitrile (11f).** Colorless crystals, yield 70%; mp>300 °C. IR 3350, 3298, 3175 ($NH_2$, NH), 2200 (CN), 1670 $cm^{-1}$ (CO). $^1H$ NMR (DMSO-$d_6$) $\delta$=4.5 (s, 1H, pyran 4-H), 7.14—7.96 (m, 9H, aromatic protons and $NH_2$ protons), 11.92 (s, 1H, NH). Found: C, 59.22; H, 3.04; N, 10.65%. Calcd for $C_{19}H_{11}Cl_2N_3O_2$: C, 59.40; H, 2.89; N, 10.97%.

**Ethyl 2-Amino-5,6-dihydro-6-ethyl-4-phenyl-5-oxo-4*H*-pyrano[3,2-*c*]quinoline-3-carboxylate (11g).** Colorless crystals, yield 70%; mp 220 °C. IR 3398, 3275 ($NH_2$), 1685 (CO), 1658 (CO), 1638 $cm^{-1}$, ($\delta NH_2$). $^1H$ NMR (DMSO-$d_6$) $\delta$=1.05—1.25 (t, $J$=7 Hz, 6H, $2CH_3$), 3.54—4.30 (m, $J$=7 Hz, 4H, $2CH_2$), 4.9 (s, 1H, pyran 4-H), 7.05—8.10 (m, 11H, aromatic protons and $NH_2$ protons). MS $m/z$ 390 (31.8%, $M^+$); 313 (100%), 267 (39%), 239 (21.3%), 211 (7.2%). Found: C, 70.53; H, 5.70; N, 7.45%. Calcd for $C_{23}H_{22}N_2O_4$: C, 70.75; H, 5.68; N, 7.17%.

**Ethyl 2-Amino-5,6-dihydro-6-ethyl-4-(4-methoxyphenyl)-5-oxo-4*H*-pyrano[3,2-*c*]quinoline-3-carboxylate (11h).** Colorless crystals, yield 68%; mp 230 °C. IR 3420, 3380 ($NH_2$), 1705 (CO), 1688 (CO), 1645 $cm^{-1}$ ($\delta NH_2$). $^1H$ NMR (DMSO-$d_6$) $\delta$=1.08—1.21 (t, $J$=7 Hz, 6H, $2CH_3$), 3.65 (s, 3H,$OCH_3$), 3.90—4.33 (m, $J$=7 Hz, 4H, $2CH_2$), 4.85 (s, 1H, pyran 4-H), 6.67—7.21 (dd, $J$=9 Hz, 4H, aromatic protons), 7.29—8.15 (m, 6H, aromatic protons and $NH_2$ protons). Found: C, 68.62; H, 5.94; N, 6.54%. Calcd for $C_{24}H_{24}N_2O_5$: C, 68.56; H, 5.73; N, 6.67%.

**Ethyl 2-Amino-4-(4-chlorophenyl)-5,6-dihydro-6-ethyl-5-oxo-4*H*-pyrano[3,2-*c*]quinoline-3-carboxylate (11i).** Pale yellow crystals, yield 70%; mp 255 °C. IR 3400, 3298 ($NH_2$), 1685 (CO), 1648 (CO), 1620 $cm^{-1}$ ($\delta NH_2$). $^1H$ NMR (DMSO-$d_6$) $\delta$=1.06—1.21 (t, $J$=7 Hz, 6H, 2 $CH_3$), 3.95—4.35 (m, $J$=7 Hz, 4H, $2CH_2$), 4.87 (s, 1H, pyran 4-H), 7.19—8.11 (m, 10H, aromatic protons and $NH_2$ protons). Found: C, 65.25; H, 4.76; N, 6.67%. Calcd for $C_{23}H_{21}ClN_2O_4$: C, 65.02: H, 4.98; N, 6.59%.

**Ethyl 2-Amino-9-chloro-5,6-dihydro-4-phenyl-5-oxo-4*H*-pyrano[3,2-*c*] quinoline-3-carboxylate (11).** Colorless crystals, yield 72%; mp>300 °C. IR 3495, 3348 ($NH_2$, NH), 1683 (CO), 1660 (CO), 1620 $cm^{-1}$ ($\delta NH_2$). $^1H$ NMR (DMSO-$d_6$) $\delta$=1.05—1.15 (t, $J$=7 Hz, 3H, $CH_3$), 3.75—4.15 (q, $J$=7 Hz, $CH_2$), 4.83 (s, 1H, pyran 4-H), 7.15—7.75 (m, 1OH, aromatic protons and $NH_2$ protons), 8.0 (s, 1H, NH). Found: C, 63.35; H, 4.64; N, 7.23%. Calcd for $C_{21}H_{17}ClN_2O_4$: C, 63.62; H, 4.33; N, 7.07%.

**Ethyl 2-Amino-9-chloro-5,6-dihydro-4-(4-methoxy-**

**phenyl)-5-oxo-4*H*-pyrano[3,2-*c*]quinoline-3-carboxylate (11k).** Colorless crystals, yield 63%; mp 289 °C. IR 3450, 3325 ($NH_2$, NH), 1685 (CO), 1662 (CO), 1623 $cm^{-1}$ ($\delta NH_2$). $^1H$ NMR (DMSO-$d_6$) $\delta$=1.06—1.26 (t, $J$=7 Hz, 3H, $CH_3$), 3.90—4.07 (q, $J$=7 Hz, 2H, $CH_2$), 4.78 (s, 1H, pyran 4-H), 6.66—7.12 (dd, $J$=9 Hz, 4H, aromatic protons), 7.26—8.06 (m, 5H, aromatic protons and $NH_2$), 11.82 (s, 1H, NH). Found: C, 64.56; H, 4.46; N, 7.11%. Calcd for $C_{22}H_{19}ClN_2O_4$: C, 64.37; H, 4.67;N, 6.83%.

**Ethyl 2-Amino-9-chloro-4-(4-chlorophenyl)-5,6-dihydro-5-oxo-4*H*-pyrano[3,2-*c*]quinoline-3-carboxylate (11l).** Colorless crystals, yield 60%; mp 297 °C. IR 3475, 3325 ($NH_2$, NH), 1682 (CO), 1660 (CO), 1620 $cm^{-1}$ ($\delta NH_2$). $^1H$ NMR (DMSO-$d_6$) $\delta$=1.0—1.18 (t, $J$=7 Hz, 3H, $CH_3$), 3.90—4.05 (q, $J$=7 Hz, 2H, $CH_2$), 4.53 (s, 1H, pyran 4-H), 7.18—7.65 (m, 7H, aromatic protons), 7.80 (s, 2H, $NH_2$), 7.98 (s, 1H, NH). Found: C, 58.23; H, 3.57; N, 6.32%. Calcd for $C_{21}H_{16}Cl_2N_2O_4$: C,58.48; H, 3.74; N, 6.50%.

**9-Amino-6,11-dioxo-7-phenyl-6*H*,11*H*-[2]benzopyrano[4,3-*c*][1]benzopyran-8,10-dicarbonitrile (15).** Orange powder, yield 60%; mp>300 °C. IR 3450, 3300 ($NH_2$), 2210, 2205 (CN), 1685, 1660 $cm^{-1}$ (CO). $^1H$ NMR (DMSO-$d_6$) $\delta$=7.40—7.85 (m, 9H, aromatic protons), 8.85 (s, 2H, $NH_2$). MS $m/z$ (405, 27.9%, $M^+$); 404 (100%), 376 (62%), 348 (7.0%), 320 (7%), 293 (4.3%), 265 (5.2%), 238 (2.7%). UV-vis $\lambda_{max}$ [nm] (DMF) 288, 325, 431, 511. Found: C, 71.34; H, 3.01; N, 10.23%. Calcd for $C_{24}H_{11}N_3O_4$: C, 71.11; H, 2.74; N, 10.37%.

**3-Bromoacetyl-4-hydroxy-1-ethyl-2(1*H*)-quinolinone (17).** A suspension of **3b** (0.01 mol) in carbon tetrachloride (100 ml) containing (0.01 mol) of *N*-bromosuccinimide, was heated under reflux for 6 h. The precipitated succinimide was filtered while hot, then left to cool overnight. The formed yellow crystals was filtered and crystallized from ethanol to give **17**, yield 75%; mp 95 °C. IR 3500—3350 (OH), 1710 (CO), 1645 (CO). Found: C, 50.47; H, 4.10; N, 4.11%. Calcd for $C_{13}H_{12}BrNO_3$: C, 50.34; H, 3.90; N, 4.52%.

**3-(3-Amino-1,3-dioxopropyl)-4-hydroxy-1-ethyl-2(1*H*)-quinolinone (19).** To a suspension of **17** (0.01 mol) in ethanol (50 ml), potassium cyanide (0.01 mol) in $H_2O$ (10 ml) was added. The reaction mixture was refluxed for 3 h on water bath, then poured on water, neutralized with dil hydrchloric acid. The product was filtered and crystallized from ethanol/dioxane to give faint brown crystals of **19**, yield 60%; mp 125 °C. IR 3530—3300 ($NH_2$, OH), 1725, 1720 (CO), 1640 (CO). $^1H$ NMR (DMSO-$d_6$) $\delta$=1.05—1.35 (t, $J$=7 Hz, 3H, $CH_3$), 2.4 (s, 2H, $NH_2$), 3.48 (s, 2H, $CH_2$), 4.15—4.43 (q, $J$=7 Hz, 2H, $CH_2$), 7.23—8.15 (m, 5H, aromatic protons and OH proton). Found: C, 61.42; H, 5.21; N, 10.12%. Calcd for $C_{14}H_{14}N_2O_4$: C, 61.31; H, 5.15, N, 10.21%.

**Formation of the Oxime 20.** A solution of **17** (0.01 mol) in ethanol (50 ml) containing sodium acetate (1 g) was heated under reflux for 10 h, then left to cool overnight at room temperature. The yellow product obtained was filtered, crystallized from ethanol and identified as **20**: yield 63%; mp 165 °C, IR 3500—3350 (OH), 1643 (CO). $^1H$ NMR (DMSO-$d_6$) $\delta$=1.08—1.28 (t, $J$=7 Hz, 3H, $CH_3$), 3.45 (s, 2H, $CH_2$), 4.2—4.38 (q, $J$=7 Hz, 2H, $CH_2$), 5.22 (s, 1H, OH), 7.25—8.24 (m, 5H, aromatic protons and OH proton). UV-vis $\lambda_{max}$ [nm] (DMF) 309.369. Found: C, 48.23; H, 3.98; N, 8.35%. Calcd for $C_{13}H_{13}BrN_2O_3$: C, 48.02; H, 4.03; N, 8.62%.

## References

1) E. A. A. Hafez, M. H. Einagdi, A. A. Elagamey, and F. M. A. El-Taweel, *Heterocycles*, **26**, 903 (1987).

2) F. M. A. El-Taweel, M. A. Sofan, M. M. Mashaly, M. A. Hanna, and A. A. Elagamey, *Pharmazie*, **45**, 671 (1990), and references cited therein.

3) T. W. Chu, Daniel, K. A. Clailorne, J. J. Clement, and J. J. Plattner, *Can. J. Chem.*, **70**, 1328 (1992).

4) J. F. Rigola, J. Pares, J. Gorbera, D. Vano, R. Merce, A. Torrens, J. Mas, and E. Valenti, *J. Med. Chem.*, **36**, 801 (1993).

5) G. B. Barlin, M. T. T. Nguyen, B. Kotecks, and K. H. Rieckmann, *Aust. J. Chem.*, **45**, 1651 (1992).

6) A. A. A. Hafez, *J. Chem. Technol. Biotechnol.*, **55**, 95 (1992).

7) L. Pentimalli, *Chim. Ind. (Milan)*, **39**, 11 (1957); *Chem. Abstr.*, **51**, 7015 (1977).

8) Y. Bansho, Sh. Surzuki, and I. Saito, *Kogyo Kagaku Zasshi*, **63**, 1390 (1960); *Chem. Abstr.*, **57**, 987 (1962).

9) A. A. Elagamey, F. M. A. El-Taweel, S. Z. A. Sowellim, M. A. Sofan, and M. H. Elnagdi, *Collect. Czech. Chem. Commun.*, **55**, 524 (1990).

10) A. A. Elagamey, F. M. A. El-Taweel, M. N. M. Khodeir, and M. H. Elnagdi, *Bull. Chem. Soc. Jpn.*, **66**, 464 (1993).

11) S. Checchc and L. P. Vottori, *Gazz. Chim Ital.*, **96**, 865 (1966).

12) B. K. Menon and K. Venkataraman, *J. Chem. Soc.*, **1931**, 2591.

13) K. Richard and G. Vogt, *Agew. Chem., Int. Ed. Engl.*, **9(112)**, 955 (1970).

14) A. Sammour, M. El-Zawahry, M. Elhashash, and A. Nagy, *Egypt J. Chem.*, **19**, 779 (1976).

15) S. Conde, C. Corral, R. Madroners, and A. S. Alvareginsua, *Synthesis*, **1976**, 412.

16) F. Ardent, L. Ergener, and O. Kutlu, *Chem. Ber.*, **86**, 951 (1953).

17) H. H. Zoorob, E. M. Afsah, and W. S. Hamama, *Pharmazie*, **40**, 246 (1985).

18) F. M. A. El-Taweel, M. N. M. Khodeir, and A. A. Elagamey, *An. Quim.*, **88**, 379 (1992).