Studies of Seven-Membered Heterocycles. XXXII.[1] Synthesis of *N*-Unsubstituted 1*H*-1,4-Benzodiazepines Stabilized by Intramolecular Hydrogen Bonding

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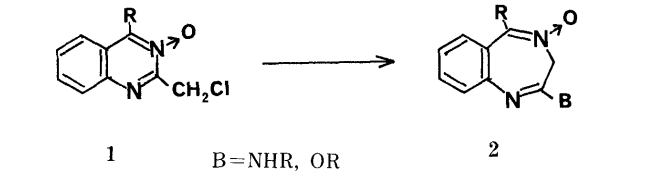
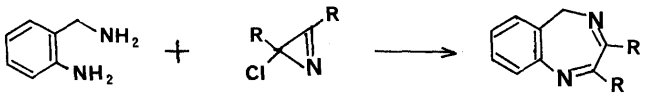
The stable *N*-unsubstituted 1*H*-1,4-benzodiazepines (12a—l) having a carbonyl group or its analogue at the 2- or 9-position were prepared from the 4-azidoquinolines (13a—l) by photoreaction in the presence of sodium methoxide. It is known that *N*-unsubstituted 1*H*-1,4-benzodiazepines having no carbonyl group are too unstable to be isolated. Based on the spectral data, the benzodiazepines (12) isolated are assumed to be stabilized by intramolecular hydrogen bonding between the 1-NH hydrogen and the 2- or 9-carbonyl oxygen, thus allowing their isolation.

Keywords 4-azidoquinoline; *N*-unsubstituted 1*H*-1,4-benzodiazepine; photolysis; ring expansion; intramolecular hydrogen bonding; stabilization

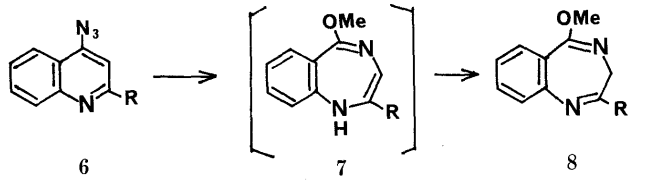
Among the six benzodiazepine isomers due to the isomeric positions of the two nitrogen atoms, 1,4-benzodiazepines have been most widely investigated owing to their biological activities,[2] but only a few examples of fully unsaturated compounds have been reported[3,4] prior to our recent studies.[5,6] Quinazoline 3-oxides (**1**) undergo bese-induced ring enlargement to give 3*H*-1,4-benzodiazepines (**2**),[3] and 5*H*-1,4-benzodiazepines (**5**)[4] can be obtained by the reaction of *o*-aminobenzylamine (**3**) with chloroazirines (**4**) or 1,2-diketones, but no 1*H*-isomers had been reported. We have recently reported[5] that the photolysis of 4-azidoquinolines (**6**) in the presence of sodium methoxide results in ring expansion to provide the first examples of *N*-unsubstituted 1*H*-1,4-benzodiazepines (**7**), which, however, are too unstable to be isolated and tautomerize to the relatively stable 3*H*-isomers (**8**) on further treatment with sodium methoxide. 3-Azidoquinolines (**9**) also undergo similar photochemical ring expansion to give 3*H*-1,4-benzodiazepines (**10**), which tautomerize to the stable 5*H*-isomers (**11**).[6]



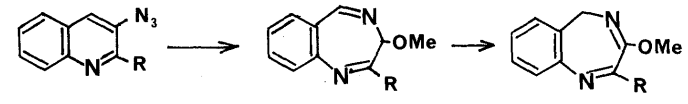
1 B=NHR, OR 2



3 4 5 R=Ph, Me



6 7 8 R=H, Me, Ph

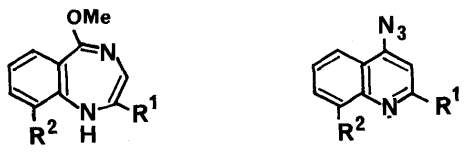


9 10 11

Chart 1

These results may indicate that of the three 1,4-benzodiazepine tautomers, the 1*H*-isomers (anti-aromatic NH form) are less stable than the 3*H*- and 5*H*-isomers (CH forms) and the stability sequence is 5*H*- > 3*H*- > 1*H*-isomers, by analogy with 1,3-benzodiazepines,[7] but in contrast to 1,2-benzodiazepines[8] in which the 1*H*-isomer (NH form) is most stable. Therefore, we were interested in the synthesis of stable *N*-unsubstituted 1*H*-1,4-benzodiazepines, and we report here that 1*H*-1,4-benzodiazepines (**12**) having a carbonyl group or its analogue in the 2- or 9-position, derived from the corresponding 4-azidoquinolines (**13**), can be isolated as stable crystals; apparently these compounds are stabilized by intramolecular hydrogen bonding.[9]

Syntheses of the Starting 4-Azidoquinolines (13a—l) Synthetic routes to the 2-substituted 4-azidoquinolines (**13a—d**) are shown in Chart 3. 4-Azido-2-carbamoylquinoline (**13a**) was prepared from 4-nitroquinoline 1-oxide (**14**) *via* 4-azidoquinoline 1-oxide by the reported method.[10] Quinoline-2-carboxylic acid (**15**)[11] was treated with ethyl chloroformate in the presence of triethylamine and then with diethylamine to afford 2-dimethylcarbamoylquinoline (**16**, 92% yield), which was oxidized with *m*-chloroperbenzoic acid (*m*-CPBA) to give the *N*-oxide of **16**. Treatment of the *N*-oxide with phosphorus oxychloride gave the 4-chloroquinoline (**17**, *ca.* 50% yield), which was treated with sodium azide to give 4-azido-2-dimethylcarbamoylquinoline (**13b**) in 87% yield. 2-Acetyl-4-azidoquinoline



12 13

R^1, R^2=carbonyl groups

Chart 2

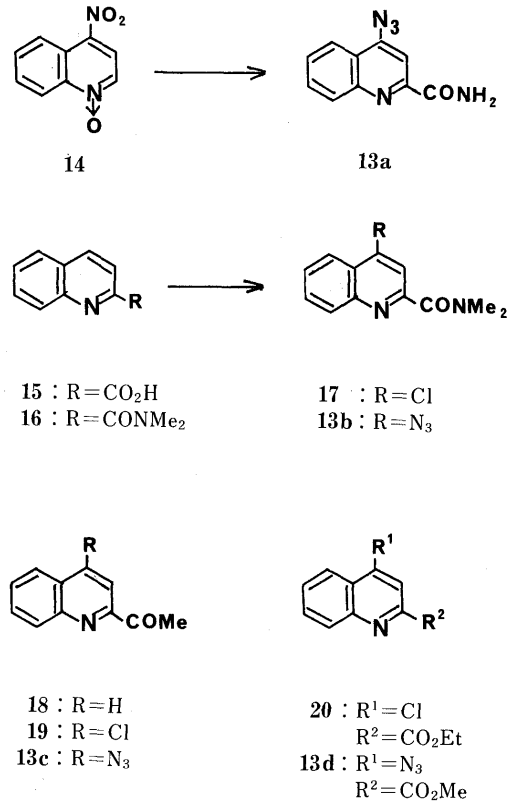


Chart 3

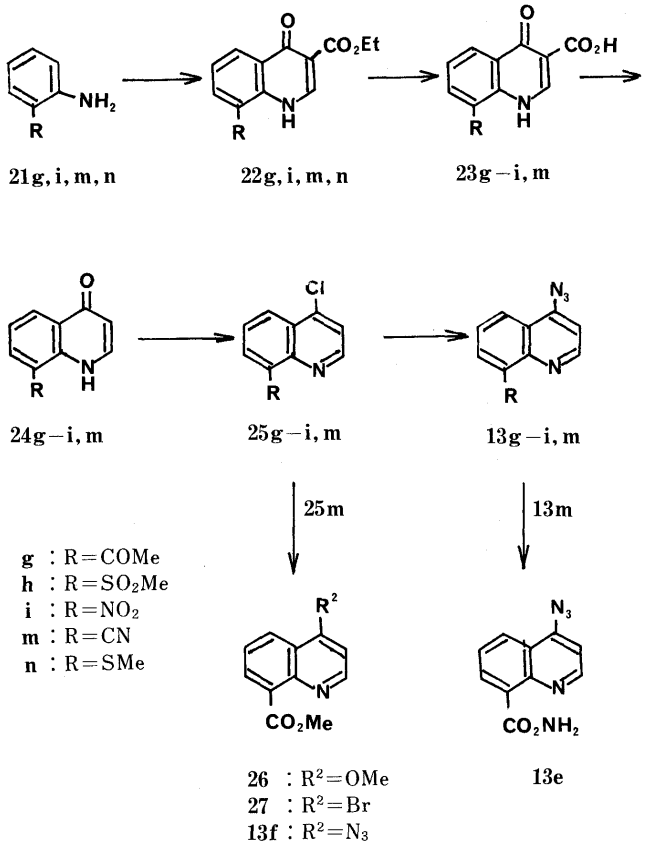


Chart 4

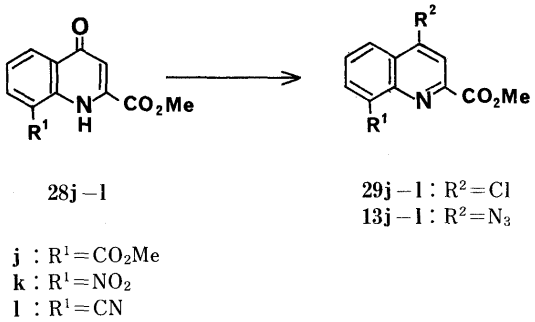


Chart 5

(**13c**) was prepared from 2-acetylquinoline (**18**)[11] in 33% yield *via* the 4-chloro compound **19** by successive treatment with *m*-CPBA, phosphorus oxychloride, and sodium azide. The chloro atom in 4-chloro-2-ethoxycarbonylquinoline (**20**)[12] was replaced by an azido group and then the ethoxycarbonyl group was changed to a methoxycarbonyl group by treatment with sodium methoxide in methanol, giving rise to 4-azido-2-methoxycarbonylquinoline (**13d**) in *ca.* 90% yield from **20**.

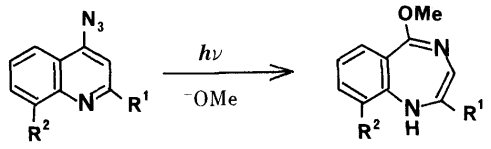
The 8-substituted 4-azidoquinolines (**13e—i**) were synthesized by the routes shown in Chart 4. The chloroquinolines (**25g—i, m**) were prepared from the anilines (**21g, i, m, n**) *via* the 4(1*H*)-quinolones (**22—24**), according to the procedure reported for the preparation of 4-chloro-8-nitroquinoline (**25i**).[13] The *o*-substituted anilines (**21g, i, m, n**) were treated with diethyl ethoxymethylenemalonate at 130 °C to result in ring closure, affording the corresponding 8-substituted 3-ethoxycarbonyl-1,4-dihydro-4-oxoquinolones (**22g, i, m, n**) in high yields. Compounds **22g, i, m** were hydrolyzed with sodium hydroxide to give the free acids (**23g, i, m**), which were decarboxylated by heating at 250 °C in diphenyl ether to afford the 1,4-dihydro-4-oxoquinolones (**24g, i, m**) in *ca.* 60% yields from **22g, i, m**. Treatment of **24g, i, m** with phosphorus oxychloride gave the corresponding 4-chloroquinolines (**25g, i, m**) in 60—80% yields. The 8-methylsulfonyl compound **23h**, obtained directly from the 8-methylthio compound **22n** by heating with hydrogen peroxide in acetic acid, was successively decarboxylated and chlorinated to give 4-chloro-8-methylsulfonylquinoline (**25h**). The 4-azidoquinolines (**13g—i, m**) were obtained from the corresponding 4-chloroquinolines (**25**) by treatment with sodium azide in high yields. 4-Azido-8-carbamoylquinoline (**13e**) was prepared from the 8-cyanoquinoline (**13m**) by treatment with hydrogen peroxide in acetone containing hydrogen chloride in 92% yield. 4-Chloro-8-cyanoquinoline (**25m**) was treated with sulfuric acid in methanol to give the 8-methoxycarbonylquinoline (**26**, 36% yield), which was successively brominated with phosphorus tribromide and azidated with sodium azide to afford 4-azido-8-methoxycarbonylquinoline (**13f**) in *ca.* 60% yield.

Finally, the 2,8-disubstituted 4-azidoquinolines (**13j—l**) were obtained in good yields (62—96% yields) by azidation of the corresponding 4-chloroquinolines (**29**), which were prepared by the reaction of the known 8-substituted 2-methoxycarbonyl-1,4-dihydro-4-oxoquinolones (**28j**,[14] **28k**,[15] **28l**[16]) with phosphorus oxychloride in 65—95% yields (Chart 5).

***N*-Unsubstituted 1*H*-1,4-Benzodiazepines** Irradiation (400 W, high-pressure Hg lamp; Pyrex filter) of the 4-azidoquinolines (**13a—l**: *ca.* 0.5 g) in methanol–dioxane (1 : 1) containing a large excess of sodium methoxide until

almost all of the starting azides had been consumed (for 20—40 min) resulted in ring expansion to give the desired 5-methoxy-1*H*-1,4-benzodiazepines (**12a—l**) in 25—65% yields, as the sole ring expansion products. In all cases, the formation of the 3*H*-isomers was not observed. All the products **12** are stable enough to be isolated by silica gel column chromatography, in contrast to the already reported *N*-unsubstituted 1*H*-1,4-benzodiazepines (**7**: R=H, Me, Ph), which are unstable and rapidly decompose during purification by chromatography or on standing even in a refrigerator.

The yields and physical, analytical, and spectral data for the products **12** are collected in Tables I and II. The proton nuclear magnetic resonance (^{1}H-NMR) spectra of the diazepines (**12**) showed the 1-NH proton signals and no signals due to methylene or methine protons, and the



13a—l 12a—l

	R^1	R^2		R^1	R^2
a	$CONH_2$	H	**g**	H	COMe
b	$CONMe_2$	H	**h**	H	SO_2Me
c	COMe	H	**i**	H	NO_2
d	CO_2Me	H	**j**	CO_2Me	CO_2Me
e	H	$CONH_2$	**k**	CO_2Me	NO_2
f	H	CO_2Me	**l**	CO_2Me	CN

Chart 6

^{13}C-nuclear magnetic resonance (^{13}C-NMR) spectra exhibited no sp^3 ring carbon signals. In the ^{1}H-NMR spectra of the 9-substituted compounds **12e—i**, an AB pair of doublets (J=6 Hz) appeared at around δ 5.3—5.4 and 5.7—5.8, assignable to 2-H and 3-H, respectively, and the former coupled further with the 1-NH proton (J=6 Hz). These data are consistent with the proposed 1*H*-structure for the products **12** and rule out 3*H*- and 5*H*-structures.

In the infrared (IR) spectra of **12**, both the carbonyl and the 1-NH absorptions appeared at lower wavelengths: *e.g.*, C=O [**12c** (COMe): 1652; **12d** (CO_2Me): 1698; **12g** (COMe): 1646 cm^{-1}] and NH 3330—3350 cm^{-1}. Furthermore, the 1-NH proton signals also appeared at lower fields (δ 5.5—8.9) than those of **7** (δ 4.7—5.1)[5] in the ^{1}H-NMR spectra of **12**. These lower shifts may be a consequence of hydrogen bonding between the 1-NH hydrogen and the C=O, N=O, or S=O oxygen, as illustrated in the structures **12** shown in Chart 7.

In the ^{1}H-NMR spectra (Table II), the 1-NH signals of the 2-substituted compounds **12a—d** appeared at δ 5.5—6.0, whereas those of the 9-substituted compounds **12** appeared at lower fields (δ 8.0—9.0) except for the 9-methylsulfonyl compound **12h** (δ 6.6). This difference in chemical shifts may arise from the fact that the hydrogen bonding forming a six-membered ring chelate for **12e—i** is stronger than that forming a five-membered ring for **12a—d**. The result for **12h** indicates that the hydrogen bonding with methylsulfonyl oxygen is relatively weak compared to that with carbonyl and nitro oxygen. In the cases of the 2,9-disubstituted 1,4-benzodiazepines **12j, k**, the values of the chemical shifts for 1-NH (δ 8.8 for **12j**; 8.6 for **12k**) are similar to those of **12e—i**, showing that the hydrogen bonding in **12j, k** occurs preferentially with the 9-substituents to produce six-

TABLE I. 5-Methoxy-1*H*-1,4-benzodiazepines (**12a—l**)

Compd. No.	Yield[a] (%)	mp (°C)	Formula (MS *m/z*: M^+)	Analysis (%) Calcd (Found) C	H	N	IR KBr cm^{-1}
12a	63	159—160[b]	$C_{11}H_{11}N_3O_2$ (217)	60.82 (60.88	5.10 5.09	19.35 19.20)	3420, 3356 (NH) 1658 (C=O)
12b	26	Oil	$C_{13}H_{15}N_3O_2$ (245)	63.66 (63.92	6.16 5.98	17.13 16.88)	3340 (NH) 1630 (C=O) (neat)
12c	38	116—118[b]	$C_{12}H_{12}N_2O_2$ (216)	66.65 (66.59	5.59 5.52	12.96 12.78)	3324 (NH) 1652 (C=O)
12d	67	143—145[b]	$C_{12}H_{12}N_2O_3$ (232)	62.06 (62.09	5.21 5.32	12.06 11.84)	3348 (NH) 1698 (C=O)
12e	45	110—112[b]	$C_{11}H_{11}N_3O_2$ (217)	60.82 (61.02	5.10 5.08	19.35 19.23)	3352, 3284, 3188 (NH) 1646 (C=O)
12f	47	72—74[c]	$C_{12}H_{12}N_2O_3$ (232)	62.06 (62.21	5.21 5.22	12.06 11.80)	3348 (NH) 1700 (C=O)
12g	31	83—85[d]	$C_{12}H_{12}N_2O_2$ (216)	66.65 (66.68	5.59 5.60	12.96 12.83)	3236 (NH) 1646 (C=O)
12h	27	107—109[d]	$C_{11}H_{12}N_2O_3S$ (252)	52.38 (52.25	4.80 4.80	11.11 10.99)	3380 (NH) 1296, 1146, 1120 (SO_2)
12i	59	133—135[d]	$C_{10}H_9N_3O_3$ (219)	54.79 (54.85	4.14 4.18	19.17 19.03)	3350 (NH) 1470, 1260 (NO_2)
12j	33	120—121[d]	$C_{14}H_{14}N_2O_5$ (290)	57.93 (57.95	4.86 4.89	9.65 9.62)	3256 (NH) 1732, 1712 (C=O)
12k	25	170—172[d]	$C_{12}H_{11}N_3O_5$ (277)	51.99 (52.23	4.00 4.11	15.16 14.98)	3340 (NH), 1724 (C=O) 1472, 1278 (NO_2)
12l	42	156—157[d]	$C_{13}H_{11}N_3O_3$ (257)	60.69 (60.73	4.31 4.35	16.34 16.36)	3336 (NH), 2220 (CN) 1712 (C=O)

a) Yield of isolated product. *b*) Orange prisms (from ether–hexane). *c*) Orange prisms (from acetone–hexane). *d*) Orange needles (from acetone–hexane).

TABLE II. ^{1}H-NMR Spectral Data for the 1,4-Benzodiazepines (**12**)

Compd. No.	1-NH[a]	($CDCl_3$)[b]
12a	5.7 (s)	3.87 (3H, s, 5-OMe), 5.6 (2H, br, $CONH_2$), 6.5—7.4 (4H, m, Ph-H), 6.56 (1H, s, 3-H)
12b	5.5 (s)	3.06 (6H, s, NMe_2), 3.84 (3H, s, 5-OMe), 6.32 (1H, s, 3-H), 6.6—7.4 (4H, m, Ph-H)
12c	6.0 (s)	2.36 (3H, s, COMe), 4.03 (3H, s, 5-OMe), 6.7—7.7 (4H, m, Ph-H) 7.28 (1H, s, 3-H)
12d	5.5 (s)	3.87 (3H, s, 5-OMe), 3.98 (3H, s, CO_2Me), 6.7—7.6 (4H, m, Ph-H), 7.24 (1H, s, 3-H)
12e	8.0 (d)	3.76 (3H, s, 5-OMe), 5.32 (1H, dd, 2-H), 5.72 (1H, d, 3-H), 6.2 (2H, br, $CONH_2$), 6.70 (1H, dd, 7-H), 7.34 (2H, d, 6- and 8-H)
12f	8.2 (d)	3.78 (3H, s, 5-OMe), 3.85 (3H, s, CO_2Me), 5.35 (1H, dd, 2-H), 5.76 (1H, d, 3-H), 6.74 (1H, dd, 7-H), 7.45 (1H, d, 6-H), 7.85 (1H, d, 8-H)
12g	8.9 (d)	2.52 (3H, s, COMe), 3.76 (3H, s, 5-OMe), 5.26 (1H, dd, 2-H), 5.72 (1H, d, 3-H), 6.72 (1H, dd, 7-H), 7.40 (1H, d, 6-H), 7.66 (1H, d, 8-H)
12h	6.6 (d)	3.30 (3H, s, SO_2Me), 3.78 (3H, s, 5-OMe), 5.44 (1H, dd, 2-H), 5.84 (1H, d, 3-H), 6.96 (1H, dd, 7-H), 7.54 (1H, d, 6-H), 7.74 (1H, d, 8-H)
12i	8.0 (d)	3.80 (3H, s, 5-OMe), 5.34 (1H, dd, 2-H), 5.86 (1H, d, 3-H), 6.79 (1H, dd, 7-H), 7.54 (1H, d, 6-H), 8.04 (1H, d, 8-H)
12j	8.8 (s)	3.76, 3.87 and 3.92 (each 3H, s, 5-OMe, $2\times CO_2Me$), 6.79 (1H, dd, 7-H), 7.08 (1H, s, 3-H), 7.44 (1H, dd, 6-H), 7.92 (1H, d, 8-H)
12k	8.6 (s)	3.73 and 3.85 (each 3H, s, 5-OMe, CO_2Me), 6.83 (1H, dd, 7-H), 7.09 (1H, s, 3-H), 7.48 (1H, d, 6-H), 8.03 (1H, d, 8-H)
12l	6.0 (s)	3.73 and 3.81 (each 3H, s, 5-OMe, CO_2Me), 6.84 (1H, dd, 7-H), 7.4 (2H, m, 6- and 8-H), 7.00 (1H, s, 3-H)

a) Broad signals. *b*) $J_{1\text{-NH},2}=6$, $J_{2,3}=6$, $J_{6,7}=8$, and $J_{7,8}=8$ Hz.

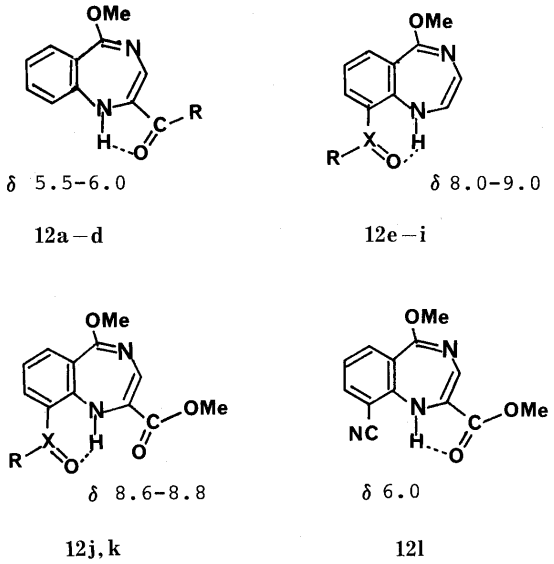


Chart 7

membered ring chelates. As was expected, the NH hydrogen in the 9-cyano compound **12l** (NH, δ 6.0) bonded with the 2-carbonyl oxygen. These spectral data strongly suggested that the 1*H*-1,4-benzodiazepines (**12**) isolated are stabilized by intramolecular hydrogen bonding. A similar hydrogen bonding effect has also been observed in 2-acyl-1*H*-azepines.[17]

As previously stated, the 1*H*-1,4-benzodiazepines (**7**) having no carbonyl group are unstable and readily tautomerize to their 3*H*-isomers (**8**) on treatment with sodium methoxide. However, the present 1*H*-1,4-benzodiazepines (**12**) did not undergo such base-induced tautomerization, except for the 2-carbamoyl compound **12a**. Treatment of **12a** with sodium methoxide in methanol at room temperature until the products ratio no longer changed (for 10—12 h) gave the 3*H*-isomer (**30**) and the starting 1*H*-diazepine (**12a**) in 15% and 80% yields, respectively. Further treatment of the isolated 3*H*-isomer

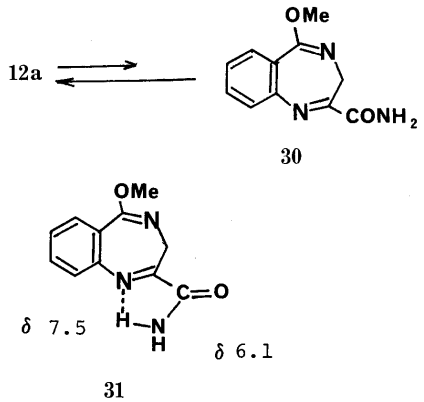


Chart 8

(**30**) with sodium methoxide afforded the 1*H*-isomer (**12a**) in *ca.* 60% yield and *ca.* 10% of **30** was recovered. These results show that under the present basic conditions compound **12a** exists in equilibrium with the 3*H*-isomer (**30**), but the equilibrium lies strongly on the side of the 1*H*-isomer.

The 3*H*-isomer (**30**) may also be stabilized by hydrogen bonding between the carbamoyl hydrogen and the ring nitrogen as shown in the structure **31** (NH_2, δ 6.1 and 7.5), so tautomerization can occur and thus the 3*H*-isomer (**30**) can be isolated, though it is less stable than the 1*H*-isomer (**12a**). In the cases of the 3*H*-isomers of the other diazepines (**12b—l**), no hydrogen bonding can exist, and thus the 1*H*-isomers stabilized by hydrogen bonding do not undergo tautomerization.

In conclusion, the products **12** reported are the first examples of isolated *N*-unsubstituted 1*H*-1,4-benzodiazepines, although the *N*-acetyl compounds have been prepared from the 3*H*-1,4-benzodiazepines (**8**) by treatment with acetyl chloride in pyridine.[5]

Experimental

The general experimental procedures were the same as in Part XXXI.[1]

4-Azido-2-carbamoylquinoline (13a) This compound was prepared from 4-nitroquinoline 1-oxide (**14**) by the reported method.[10]

2-Dimethylcarbamoylquinoline (16) Ethyl chloroformate (5.7 g, 53 mmol) was added dropwise with stirring to a solution of quinoline-2-carboxylic acid[11] (**15**, 8.65 g, 50 mmol) and triethylamine (5.56 g, 55 mmol) in $CHCl_3$ (100 ml) in an ice bath. The mixture was stirred for an additional 1 h, then dimethylamine (50% aqueous solution, 9.0 g, 2 mol eq) was added dropwise at 0 °C. The reaction mixture was stirred for 1 h at room temperature and then poured into ice-water. The aqueous mixture was extracted with CH_2Cl_2 and the extract was washed with brine, dried over $MgSO_4$, and evaporated *in vacuo*. The residue was chromatographed on silica gel using hexane–CH_2Cl_2 (1 : 2) as an eluent to give **16**, 9.21 g, 92% yield, viscous colorless oil. MS *m/z*: 200 (M^+). IR (neat): 1638 (C=O) cm^{-1}. ^{1}H-NMR δ: 3.13 and 3.17 (each 3H, s, NMe_2), 7.6—8.5 (6H, m, Ar-H). *Anal.* Calcd for $C_{12}H_{12}N_2O$: C, 71.98; H, 6.04; N, 13.99. Found: C, 72.14; H, 6.02; N, 13.70.

4-Chloro-2-dimethylcarbamoylquinoline (17) *m*-CPBA (3.3 g) was added in small portions to a solution of **16** (3.0 g, 15 mmol) in $CHCl_3$ (100 ml) with stirring in an ice bath and the reaction mixture was further stirred for 24 h, then washed with saturated $NaHCO_3$, dried and evaporated *in vacuo*. The residue was chromatographed on silica gel using CH_2Cl_2–acetone (4 : 1) as an eluent to give the 1-oxide of **16**: 2.54 g, 78% yield. This *N*-oxide was too hygroscopic to be purified, so it was used for the following chlorination without further purification. A solution of the *N*-oxide (2.54 g) and $POCl_3$ (8 ml) in $CHCl_3$ (50 ml) was refluxed for 3 h, and then poured into ice-water. The aqueous mixture was made alkaline with $NaHCO_3$ and extracted with CH_2Cl_2. The extract was washed with brine, dried, and evaporated *in vacuo*. The residue was chromatographed on silica gel using CH_2Cl_2–hexane (2 : 1) as an eluent to give **17**: 1.39 g, 50% yield, mp 62—63 °C, colorless needles (from hexane). MS *m/z*: 234 and 236 (M^+). IR (KBr): 1652 (C=O) cm^{-1}. ^{1}H-NMR δ: 3.22 (6H, s, NMe_2), 7.6—8.4 (4H, m, Ph-H), 7.88 (1H, s, 3-H). *Anal.* Calcd for $C_{12}H_{11}ClN_2O$: C, 61.41; H, 4.72; N, 11.94. Found: C, 61.24; H, 4.59; N, 11.70.

4-Azido-2-dimethylcarbamoylquinoline (13b) A solution of **17** (1.17 g, 5 mmol) and sodium azide (0.65 g, 10 mmol) in dimethyl sulfoxide (DMSO) (20 ml) was heated at 80 °C for 4 h, and then poured into ice-water. The aqueous mixture was extracted with CH_2Cl_2 and the extract was washed with water, dried, and evaporated *in vacuo*. The residue was chromatographed on silica gel using CH_2Cl_2 as an eluent to give **13**: 1.05 g, 87% yield, mp 87—89 °C, colorless needles (from acetone–hexane). MS *m/z*: 241 (M^+). IR (KBr): 2120 (N_3), 1644 (C=O) cm^{-1}. ^{1}H-NMR δ: 3.20 (6H, s, NMe_2), 7.50 (1H, s, 3-H), 7.5—7.8 and 7.9—8.1 (each 2H, m, Ar-H). *Anal.* Calcd for $C_{12}H_{11}N_5O$: C, 59.74; H, 4.60; N, 29.03. Found: C, 59.94; H, 4.79; N, 28.99.

2-Acetyl-4-chloroquinoline (19) 2-Acetylquinoline[11] (**18**, 17.1 g) was treated with *m*-CPBA (21.6 g) and worked up as described for **17** to give 2-acetylquinoline 1-oxide: 11.2 g, 60% yield, mp 92—94 °C, yellow needles (from acetone–hexane). MS *m/z*: 187 (M^+). IR (KBr): 1674 (C=O) cm^{-1}. ^{1}H-NMR δ: 3.07 (3H, s, COMe), 7.7—8.0 (5H, m, Ar-H), 8.70 (1H, d, J=9 Hz, 8-H). *Anal.* Calcd for $C_{11}H_9NO_2$: C, 70.58; H, 4.85; N, 7.48. Found: C, 70.39; H, 5.03; N, 7.22.

A solution of the *N*-oxide (9.35 g) was treated with $POCl_3$ (10 ml) in $CHCl_3$ (80 ml) and worked up as described for **17** to give **19**, 5.77 g, 56% yield, mp 96—98 °C, colorless needles (from acetone–hexane). MS *m/z*: 205, 207 (M^+). IR (KBr): 1682 (C=O) cm^{-1}. ^{1}H-NMR δ: 2.86 (3H, s, COMe), 7.5—7.9 and 8.2—8.4 (3H, m, and 2H, m, Ph-H), 8.20 (1H, s, 3-H). *Anal.* Calcd for $C_{11}H_8ClNO$: C, 64.23; H, 3.89; N, 6.81. Found: C, 64.42; H, 4.11; N, 6.66.

2-Acetyl-4-azidoquinoline (13c) Compound **19** (3.08 g) was treated with sodium azide (19.5 g) and worked up as described for **13b** to give **13c**: 2.73 g, 86% yield, mp 103—104 °C, colorless needles (from acetone–hexane). MS *m/z*: 212 (M^+). IR (KBr): 2112 (N_3), 1698 (C=O) cm^{-1}. ^{1}H-NMR δ: 2.86 (3H, s, COMe), 7.5—8.2 (4H, m, Ph-H), 7.74 (1H, s, 3-H). *Anal.* Calcd for $C_{11}H_8N_4O$: C, 62.25; H, 3.80; N, 26.40. Found: C, 62.26; H, 3.70; N, 26.43.

4-Azido-2-methoxycarbonylquinoline (13d) 4-Chloro-2-ethoxycarbonylquinoline[12] (**20**, 11.8 g) was treated with sodium azide (6.5 g) and worked up as described for **13b** to give 4-azido-2-ethoxycarbonylquinoline: 11.1 g, 92% yield, mp 73—75 °C, colorless needles (from acetone–hexane). MS *m/z*: 242 (M^+). IR (KBr): 2112 (N_3), 1740 (C=O) cm^{-1}. ^{1}H-NMR δ: 1.59 and 4.78 (3H, t, and 2H, q, J=7 Hz, CO_2Et), 7.9—8.8 (4H, m, Ph-H), 8.36 (1H, s, 3=H). *Anal.* Calcd for $C_{12}H_{10}N_4O_2$: C, 59.50; H, 4.16; N, 23.13. Found: C, 59.31; H, 4.00; N, 22.98.

A solution of the above compound (2.24 g) and sodium methoxide (0.3 g) in methanol (100 ml) was stirred for 1 h at room temperature and then poured into ice-water. The aqueous mixture was extracted with CH_2Cl_2 and the extract was washed with brine, dried, and evaporated *in vacuo*. The resulting solid residue was recrystallized from acetone–hexane to give **13d**: 2.02 g, 89% yield, mp 130—131 °C, colorless needles. MS *m/z*: 228 (M^+). IR (KBr): 2124 (N_3), 1718 (C=O) cm^{-1}. ^{1}H-NMR δ: 4.19 (3H, s, CO_2Me), 7.7—8.5 (4H, m, Ph-H), 8.15 (1H, s, 3-H). *Anal.* Calcd for $C_{11}H_8N_4O_2$: C, 57.89; H, 3.53; N, 24.55. Found: C, 57.98; H, 3.50; N, 24.14.

8-Cyano-3-ethoxycarbonyl-1,4-dihydro-4-oxoquinolone (22m) A mixture of *o*-aminobenzonitrile (**21m**, 11.8 g, 0.1 mol) and diethyl ethoxymethylenemalonate (DEMM) (21.6 g, 0.1 mol) was heated at 130 °C until the evolution of ethanol ceased (for 1—2 h) and was then added to boiling diphenyl ether (250 ml). The mixture was heated at 250 °C for 1 h, cooled, and diluted with petroleum ether (250 ml). The resulting precipitates were collected by filtration, washed with hexane, and recrystallized from methanol to give **22m**: 23.7 g, 98% yield, mp 268—269 °C, colorless prisms. IR (KBr): 3200—3300 (NH), 2250 (CN), 1714 (C=O), 1626 (C=O) cm^{-1}. *Anal.* Calcd for $C_{13}H_{10}N_2O_3$: C, 64.46; H, 4.16; N, 11.57. Found: C, 64.25; H, 4.33; N, 11.60.

8-Cyano-1,4-dihydro-4-oxoquinolone-3-carboxylic Acid (23m) A mixture of **22m** (24.2 g) and 10% NaOH (200 ml) was refluxed for 1 h, cooled, and acidified with HCl. The resulting precipitates were collected by filtration, washed with water, and recrystallized from methanol to give **23m**: 20.3 g, 95% yield, mp 250 °C, colorless prisms. IR (KBr): 3448 (OH, NH), 2244 (CN), 1718 (C=O), 1622 (C=O) cm^{-1}. *Anal.* Calcd for $C_{11}H_6N_2O_3$: C, 61.68; H, 2.82; N, 13.08. Found: C, 61.50; H, 2.80; N, 13.03.

8-Cyano-1,4-dihydro-4-oxoquinolone (24m) Compound **23m** (21.4 g) was added in small portions to boiling diphenyl ether (200 ml) and the mixture was heated at 250 °C for 1 h under a nitrogen atmosphere, then allowed to cool and diluted with hexane (400 ml). The resulting precipitates were collected, washed with hexane, and recrystallized from methanol to give **24m**: 10.2 g, 65% yield, mp 260—262 °C, colorless prisms. IR (KBr): 3088 (NH), 2232 (CN), 1630 (C=O) cm^{-1}. *Anal.* Calcd for $C_{10}H_6N_2O$: C, 70.58; H, 3.55; N, 16.46. Found: C, 70.85; H, 3.52; N, 16.22.

4-Chloro-8-cyanoquinoline (25m) A mixture of **24m** (17.0 g) and $POCl_3$ (30 ml) was refluxed for 1 h and then poured into ice-water. The aqueous mixture was made alkaline with $NaHCO_3$ and extracted with CH_2Cl_2. The extract was washed with brine, dried, and evaporated *in vacuo*. The residue was chromatographed on silica gel using CH_2Cl_2 as an eluent to give **25m**: 15.5 g, 82% yield, mp 210—211 °C, colorless needles (from acetone). MS *m/z*: 188, 190 (M^+). IR (KBr): 2225 (CN) cm^{-1}. ^{1}H-NMR δ: 7.58 (1H, d, 3-H), 7.63 (1H, dd, 6-H), 8.16 (1H, d, 5-H), 8.44 (1H, d, 7-H), 8.92 (1H, d, 2-H), $J_{2,3}$=5, $J_{5,6}$=8, $J_{6,7}$=8 Hz. *Anal.* Calcd for $C_{10}H_5ClN_2$: C, 63.66; H, 2.65; N, 14.85. Found: C, 63.50; H, 2.77; N, 14.85.

4-Azido-8-cyanoquinoline (13m) Compound **25m** (1.88 g) was azidated according to the procedure described for **13b** to give **13m**: 1.42 g, 73% yield, mp 161—162 °C, colorless prisms (from acetone–hexane). MS *m/z*: 195 (M^+). IR (KBr): 2220 (CN), 2110 (N_3) cm^{-1}. ^{1}H-NMR δ: 7.23 (1H, d, 3-H), 7.56 (1H, dd, 6-H), 8.12 (1H, d, 5-H), 8.23 (1H, d, 7-H), 8.95 (1H, d, 2-H), $J_{2,3}$=5, $J_{5,6}$=8, $J_{6,7}$=8 Hz. *Anal.* Calcd for $C_{10}H_5N_5$: C, 61.53; H, 2.58; N, 35.88. Found: C, 61.79; H, 2.59; N, 35.78.

4-Azido-8-carbamoylquinoline (13e) A mixture of **13m** (390 mg), acetone (20 ml), 30% H_2O_2 (10 ml), and 6 N HCl (0.3 ml) was heated at 50—60 °C for 2.5 h with stirring. After cooling, the resulting precipitates were collected, washed with water, and recrystallized from ethanol to give **13e**: 391 mg, 92% yield, mp 205—206 °C, colorless needles. MS *m/z*: 213 (M^+). IR (KBr): 3250 (NH), 2110 (N_3), 1670 (C=O) cm^{-1}. ^{1}H-NMR (CD_3OD) δ: 4.42 (2H, s, $CONH_2$), 7.29 (1H, d, 3-H), 7.64 (1H, dd, 6-H), 8.30 (1H, d, 5-H), 8.74 (1H, d, 7-H), 8.85 (1H, d, 2-H), $J_{2,3}$=6, $J_{5,6}$=8, $J_{6,7}$=8 Hz. *Anal.* Calcd for $C_{10}H_7N_5O$: C, 56.33; H, 3.31; N, 32.85. Found: C, 56.14; H, 3.33; N, 32.77.

4-Azido-8-methoxycarbonylquinoline (13f) *via* 26 and 27 Concentrated H_2SO_4 (20 ml) was added slowly to a solution of **25m** (3.77 g) in methanol (200 ml) with stirring in an ice bath and the mixture was refluxed for 24 h, and then poured into ice-water. The aqueous mixture was made alkaline with Na_2CO_3 and extracted with CH_2Cl_2. The extract was washed with brine, dried, and evaporated *in vacuo*. The residue was chromatographed on silica gel using CH_2Cl_2–acetone (20 : 1) as an eluent to give 4-methoxy-8-methoxycarbonylquinoline (**26**): 1.56 g, 36% yield, mp 103—106 °C, colorless prisms (from acetone–hexane). MS *m/z*: 217 (M^+). IR (KBr): 1734 (C=O) cm^{-1}. ^{1}H-NMR δ: 3.96 and 4.00 (each 3H, s, OMe and CO_2Me), 6.71 (1H, d, 3-H), 7.46 (1H, dd, 6-H), 7.96 (1H, d, 5-H), 8.30 (1H, d, 7-H), 8.84 (1H, d, 2-H), $J_{2,3}$=5, $J_{5,6}$=7, $J_{6,7}$=8 Hz.

Phosphorus tribromide (3 ml) was added to a stirred solution of **26**

(1.3 g) in *N,N*-dimethylformamide (DMF) (30 ml) in an ice bath. The reaction mixture was further stirred for 2 h at 80 °C and then poured into ice-water. The aqueous mixture was made alkaline with NaOH and extracted with CH_2Cl_2. The extract was washed with brine, dried, and evaporated. The residue was chromatographed on silica gel using CH_2Cl_2–acetone (50 : 1) as an eluent to give 4-bromo-8-methoxycarbonylquinoline (**27**): 1.04 g, 65% yield, mp 55—56 °C, pale yellow needles (from hexane). MS *m/z*: 265, 267 (M^+). IR (KBr): 1736 (C=O) cm^{-1}. ^{1}H-NMR δ: 4.04 (3H, s, CO_2Me), 7.6 (1H, d, 6-H), 7.71 (1H, d, 3-H), 8.02 (1H, d, 5-H), 8.26 (1H, d, 7-H), 8.78 (1H, d, 2-H), $J_{2,3}=5$, $J_{5,6}=7$, $J_{6,7}=8$ Hz.

A solution of **27** (0.8 g) and sodium azide (0.4 g) in DMSO (15 ml) was stirred for 5 h at room temperature and worked up as described for **13b** to give **13f**: 0.62 g, 94% yield, mp 70—73 °C, colorless needles (from acetone–hexane). MS *m/z*: 228 (M^+). IR (KBr): 2128 (N_3), 1718 (C=O) cm^{-1}. ^{1}H-NMR δ: 4.05 (3H, s, CO_2Me), 7.18 (1H, d, 3-H), 7.57 (1H, dd, 6-H), 8.03 (1H, d, 5-H), 8.22 (1H, d, 7-H), 8.97 (1H, d, 2-H), $J_{2,3}=8$, $J_{5,6}=8$, $J_{6,7}=8$ Hz. *Anal.* Calcd for $C_{11}H_8N_4O_2$: C, 57.89; H, 3.53; N, 24.55. Found: C, 57.81; H, 3.29; N, 24.38.

4-Azido-8-acetylquinoline (13g) ***via*** **21g—25g** *o*-Aminoacetophenone (**21g**, 6.75 g) was treated with DEMM (11.88 g) and worked up as described for **22m** to give 8-acetyl-3-ethoxycarbonyl-1,4-dihydro-4-oxoquinoline (**22g**): 12.8 g, 99% yield, mp 268—269 °C, colorless prisms. MS *m/z*: 259 (M^+). IR (KBr): 3248 (NH), 1742 (C=O), 1616 (C=O) cm^{-1}. Compound **22g** (15.75 g) was hydrolyzed with HCl according to the procedure described for **23m** to give 8-acetyl-1,4-dihydro-4-oxoquinoline-3-carboxylic acid (**23g**): 10.2 g, 73% yield, mp 265 °C, yellow needles. MS *m/z*: 231 (M^+). IR (KBr): 3500 (OH), 3208 (NH), 1730 (C=O), 1658 (C=O) cm^{-1}. Compound **23g** (10.2 g) was decarboxylated according to the procedure described for **24m** to give 8-acetyl-1,4-dihydro-4-oxoquinoline (**24g**): 3.5 g, 42% yield, mp 168—170 °C, yellow prisms. MS *m/z*: 187 (M^+). IR (KBr): 3268 (NH), 1658 (C=O), 1626 (C=O) cm^{-1}. This compound (**24g**, 1.87 g) was chlorinated according to the procedure described for **25m** to give **25g**: 1.14 g, 55% yield, mp 91—92 °C, colorless needles. MS *m/z*: 205, 207 (M^+). IR (KBr): 1694 (C=O) cm^{-1}. ^{1}H-NMR δ: 2.92 (3H, s, COMe), 7.52 (1H, d, 3-H), 7.66 (1H, dd, 6-H), 7.96 (1H, d, 5-H), 8.34 (1H, d, 7-H), 8.83 (1H, d, 2-H), $J_{2,3}=5$, $J_{5,6}=8$, $J_{6,7}=8$ Hz.

Compound **25g** (2.05 g) was azidated according to the procedure described for **13m** to give **13g**: 1.34 g, 63% yield, mp 78—79 °C, colorless needles. MS *m/z*: 212 (M^+). IR (KBr): 2124 (N_3), 1696 (C=O), cm^{-1}. ^{1}H-NMR δ: 2.86 (3H, s, COMe), 7.03 (1H, d, 3-H), 7.45 (1H, dd, 6-H), 7.87 (1H, d, 5-H), 8.03 (1H, d, 7-H), 8.74 (1H, d, 2-H), $J_{2,3}=5$, $J_{5,6}=8$, $J_{6,7}=8$ Hz. *Anal.* Calcd for $C_{11}H_{18}N_4O$: C, 62.25; H, 3.80; N, 26.40. Found: C, 61.99; H, 3.80; N, 26.11.

4-Azido-8-methylsulfonylquinoline (13h) ***via*** **21h—25h** *o*-Methylthioaniline (**21h**, 27.8 g) was treated with DEMM (43.2 g) and worked up as described for **22m** to give 3-ethoxycarbonyl-8-methylthio-1,4-dihydro-4-oxoquinolone (**22h**): 44.9 g, 63% yield, mp 206—207 °C, colorless prisms. MS *m/z*: 263 (M^+). IR (KBr): 3100 (NH), 1716 (C=O), 1608 (C=O) cm^{-1}. A mixture of **22h** (26.3 g), 30% H_2O_2 (60 ml), and AcOH (500 ml) was heated at 80—90 °C for 18 h, and then concentrated to *ca.* 50 ml *in vacuo*. The resulting precipitates were collected by filtration, washed with water, and recrystallized from methanol to give 8-methylsulfonyl-1,4-dihydro-4-oxoquinolone-3-carboxylic acid (**23h**): 6.7 g, 25% yield, mp 190 °C, colorless prisms. MS *m/z*: 267 (M^+). IR (KBr): 3540 (OH), 3220 (NH), 1722 (C=O), 1612 (C=O), 1310 and 1176 (SO_2) cm^{-1}. *Anal.* Calcd for $C_{11}H_9NO_5S$: C, 49.45; H, 3.40; N, 5.24. Found: C, 49.33; H, 3.12; N, 5.02.

Compound **23h** (13.4 g) was added in small portions to boiling diphenyl ether (200 ml) and the mixture was heated at 230—245 °C for 1 h. Then it was allowed to cool, and $POCl_3$ (50 ml) was added. The reaction mixture was heated at 135—140 °C for 1 h and then poured into ice-water. The aqueous mixture was worked up as described for **25m** to give 4-chloro-8-methylsulfonylquinoline (**25h**): 8.09 g, 67% yield, mp 168—169 °C, colorless prisms. MS *m/z*: 241, 243 (M^+). IR (KBr): 1292 and 1130 (SO_2) cm^{-1}. ^{1}H-NMR δ: 3.63 (3H, s, SO_2Me), 7.70 (1H, d, 3-H), 7.84 (1H, dd, 6-H), 8.58 (1H, d, 5-H), 8.66 (1H, d, 7-H), 9.03 (1H, d, 2-H), $J_{2,3}=5$, $J_{5,6}=8$, $J_{6,7}=8$ Hz. *Anal.* Calcd for $C_{10}H_8ClNO_2S$: C, 49.71; H, 3.34; N, 5.80. Found: C, 49.99; H, 3.33; N, 5.66.

Compound **25h** (2.41 g) was azidated according to the procedure described for **13m** to give **13h**: 2.42, 98% yield, mp 173—174 °C, yellow prisms. MS *m/z*: 248 (M^+). IR (KBr): 2120 (N_3), 1296 and 1138 (SO_2) cm^{-1}. ^{1}H-NMR δ: 3.58 (3H, s, SO_2Me), 7.28 (1H, d, 3-H), 7.65 (1H, dd, 6-H), 8.36 (1H, d, 5-H), 8.54 (1H, d, 7-H), 9.00 (1H, d, 2-H), $J_{2,3}=5$, $J_{5,6}=8$, $J_{6,7}=8$ Hz. *Anal.* Calcd for $C_{10}H_8N_4O_2S$: C, 48.39; H, 3.25; N, 22.58. Found: C, 48.38; H, 3.22; N, 22.82.

4-Azido-8-nitroquinoline (13i) 4-Chloro-8-nitroquinoline (**25i**, 2.08 g), prepared from *o*-nitroaniline (**21i**) *via* **22i**, **23i**, and **24i** successively by the reported method,[13] was azidated according to the procedure described for **13b** to give **13i**: 1.23 g, 57% yield, mp 185—187 °C, colorless needles (from acetone–hexane). MS *m/z*: 215 (M^+). IR (KBr): 2124 (N_2) cm^{-1}. ^{1}H-NMR δ: 7.28 (1H, d, 3-H), 7.60 (1H, dd, 6-H), 8.06 (1H, d, 5-H), 8.30 (1H, d, 7-H), 8.90 (1H, d, 2-H), $J_{2,3}=6$, $J_{5,6}=8$, $J_{6,7}=8$ Hz. *Anal.* Calcd for $C_9H_5N_5O_2$: C, 50.23; H, 2.34; N, 32.55. Found: C, 50.35; H, 2.28; N, 32.40.

8-Substituted 4-Chloro-2-methoxycarbonylquinolines (29j—l) 2,8-Dimethoxycarbonyl-1,4-dihydro-4-oxoquinoline[14] (**28j**, 4.80 g), 2-methoxycarbonyl-8-nitro-1,4-dihydro-4-oxoquinoline[15] (**28k**, 5.0 g), and 8-cyano-2-methoxycarbonyl-1,4-dihydro-4-oxoquinoline[16] (**28l**, 4.56 g), prepared by the cited methods were chlorinated with $POCl_3$ according to the procedure described for **25m** to give **29j—l**.

4-Chloro-2,8-dimethoxycarbonylquinoline (**29j**): 4.82 g, 93% yield, mp 102—103 °C, colorless needles. MS *m/z*: 279, 281 (M^+). IR (KBr): 1718 (C=O) cm^{-1}. ^{1}H-NMR δ: 4.02 (6H, s, 2 CO_2Me), 7.68 (1H, dd, 6-H), 8.11 (1H, d, 5-H), 8.24 (1H, s, 3-H), 8.36 (1H, d, 7-H), $J_{5,6}=8$, $J_{6,7}=8$ Hz. *Anal.* Calcd for $C_{13}H_{10}ClNO_4$: C, 55.83: H, 3.60; N, 5.01. Found: C, 55.75; H, 3.49; N, 5.00.

4-Chloro-2-methoxycarbonyl-8-nitroquinoline (**29k**): 3.35 g, 62% yield, mp 155—158 °C, yellow needles. MS *m/z*: 266, 268 (M^+). IR (KBr): 1722 (C=O) cm^{-1}. ^{1}H-NMR δ: 4.06 (3H, s, CO_2Me), 7.83 (1H, dd, 6-H), 8.13 (1H, d, 5-H), 8.36 (1H, s, 3-H), 8.50 (1H, d, 7-H), $J_{5,6}=8$, $J_{6,7}=8$ Hz. *Anal.* Calcd for $C_{11}H_7ClN_2O_4$: C, 49.55; H, 2.65; N, 10.51. Found: C, 49.31; H, 2.65; N, 10.29.

4-Chloro-8-cyano-2-methoxycarbonylquinoline (**29l**): 4.72 g, 96% yield, mp 199—200 °C, colorless needles. MS *m/z*: 246, 248 (M^+). IR (KBr): 2236 (CN), 1722 (C=O) cm^{-1}. ^{1}H-NMR δ: 4.10 (3H, s, CO_2Me), 7.84 (1H, dd, 6-H), 8.30 (1H, d, 5-H), 8.39 (1H, s, 3-H), 8.55 (1H, d, 7-H), $J_{5,6}=8$, $J_{6,7}=8$ Hz. *Anal.* Calcd for $C_{12}H_7ClN_2O_2$: C, 58.43; H, 2.86; N, 11.36. Found: C, 58.13; H, 2.73; N, 11.16.

8-Substituted 4-Azido-2-methoxycarbonylquinolines (13j—l) Compounds **29j—l** (*ca.* 5 g) were azidated according to the procedure described for **13b** to give **13j—l**.

4-Azido-2,8-dimethylcarbonylquinoline (**13j**): 76% yield, mp 143—144 °C, colorless needles. MS *m/z*: 286 (M^+). IR (KBr): 2132 (N_3), 1736 (C=O), 1722 (C=O) cm^{-1}. ^{1}H-NMR δ: 4.04 (6H, s, 2 CO_2Me), 7.59 (1H, dd, 6-H), 7.94 (1H, s, 3-H), 8.12 (1H, d, 5-H), 8.20 (1H, d, 7-H), $J_{5,6}=8$, $J_{6,7}=8$ Hz. *Anal.* Calcd for $C_{13}H_{10}N_4O_4$: C, 54.55; H, 3.52; N, 19.58. Found: C, 54.75; H, 3.49; N, 19.57.

4-Azido-2-methoxycarbonyl-8-nitroquinoline (**13k**): 64% yield, mp 174—175 °C, yellow needles. MS *m/z*: 273 (M^+). IR (KBr): 2124 (N_3), 1725 (C=O) cm^{-1}. ^{1}H-NMR δ: 4.02 (3H, s, CO_2Me), 7.63 (1H, dd, 6-H), 7.99 (1H, s, 3-H), 8.07 (1H, d, 5-H), 8.23 (1H, d, 7-H), $J_{5,6}=8$, $J_{6,7}=8$ Hz. *Anal.* Calcd for $C_{11}H_7N_5O_4$: C, 48.35; H, 2.58; N, 25.04. Found: C, 48.32; H, 2.57; N, 25.40.

4-Azido-8-cyano-2-methoxycarbonylquinoline (**13l**): 96% yield, mp 176—177 °C, yellow needles. MS *m/z*: 253 (M^+). IR (KBr): 2240 (CN), 2120 (N_3), 1722 (C=O) cm^{-1}. ^{1}H-NMR δ: 4.08 (3H, s, CO_2Me), 7.68 (1H, dd, 6-H), 8.04 (1H, s, 3-H), 8.21 (1H, d, 5-H), 8.36 (1H, d, 7-H), $J_{5,6}=8$, $J_{6,7}=8$ Hz. *Anal.* Calcd for $C_{12}H_7N_5O_2$: C, 56.91; H, 2.79; N, 27.66. Found: C, 56.93; H, 2.72; N, 27.75.

Photolysis of the 4-Azidoquinolines (13): Formation of 5-Methoxy-1*H*-1,4-benzodiazepines (12a—l) General Procedure: A solution of **13** (*ca.* 0.5 g) and sodium methoxide (0.8 g) in methanol–dioxane (1 : 1, 140 ml) was irradiated (400 W, high-pressure Hg lamp, Pyrex filter) for *ca.* 30 min under a nitrogen atmosphere. After removal of the solvent *in vacuo*, ice-water (10—20 ml) was added to the residue and the aqueous mixture was extracted with CH_2Cl_2. The extract was washed with brine, dried, and evaporated *in vacuo*. The residue was chromatographed on silica gel using ether–hexane as an eluent to give **12**.

Physical, analytical, and spectral data for **12a—l** are collected in Tables I and II.

Treatment of 12a with Sodium Methoxide in Methanol: Formation of 2-Carbamoyl-5-methoxy-3*H*-1,4-benzodiazepine (30) A mixture of **12a** (156 mg) and sodium methoxide (650 mg) in methanol (20 ml) was stirred at room temperature until the pattern of spots on thin-layer chromatography of the reaction mixture no longer changed (for 10—12 h), and then poured into ice-water. The aqueous mixture was extracted with CH_2Cl_2 and the extract was washed with brine, dried, and evaporated *in vacuo*. The residue was chromatographed on silica gel using ether–hexane (1 : 3) as an eluent to give **12a** (125 mg, 80% recovery) and **30** (24 mg, 15%

yield).

30: mp 147—150 °C, colorless prisms (from acetone–hexane). MS *m/z*: 217 (M^+). IR (KBr): 3460, 3224 and 3144 (NH), 1678 (C=O) cm^{-1}. ^{1}H-NMR δ: 3.83 (3H, s, 5-OMe), 4.04 (2H, s, 2-H_2), 6.1 and 7.5 (each 1H, br, $CONH_2$), 7.2—7.9 (4H, m, Ph-H). ^{13}C-NMR δ: 41.8 (t, 3-C), 54.4 (q, 5-OMe), 161.0 (s, 2-C), 163.3 (s, 5-C), Ph-C [124.8 (s), 126.9 (d), 127.4 (d), 128.8 (d), 131.3 (d), 146.2 (s)]. *Anal.* Calcd for $C_{11}H_{11}N_3O_2$: C, 60.82; H, 5.10; N, 19.35. Found: C, 60.75; H, 5.32; N, 19.20.

Treatment of 30 with Sodium Methoxide Compound **30** (32 mg) was treated with sodium methoxide in methanol and worked up as described for **12a** to give **12a** (20 mg, 60%) and **30** (5 mg, 15%).

References and Notes

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