A Facile Synthesis of 2,3-Dihydroimidazo- and 1,2,3,4-Tetrahydropyrimido[1,2-*f*]phenanthridines

Hsi-Lung Pan and T. Lloyd Fletcher

Chemistry Research Laboratory of the Department of Surgery,
School of Medicine, University of Washington, Seattle, Washington 98195

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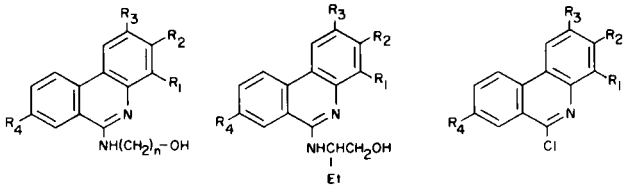
When 6-(2-hydroxyethyl)amino- (**1**), 6-(3-hydroxypropyl)amino- (**2**), or 6-[2-(1-hydroxybutyl)]-aminophenanthridines (**3**), dissolved in concentrated sulfuric acid, were treated with nitrosylsulfuric acid at 0-25°, then diluted with water and basified with aqueous sodium hydroxide at 65-86°, 2,3-dihydroimidazo- (**4a-i**), 1,2,3,4-tetrahydropyrimido- (**5**), or 2,3-dihydro-2-ethylimidazo[1,2-*f*]phenanthridines (**4j-p**) were obtained respectively in good yields. Structures were substantiated by ir spectroscopy. The 6-ω-hydroxyalkylaminophenanthridines were prepared from the corresponding 6-chlorophenanthridines. A possible mechanism for the formation of these ring systems is postulated.

In a search for new heterocyclic compounds with possible antitumor activity, a series of 6(5*H*)-phenanthridinones was synthesized (1-3). As an extension of this study we made a number of 6-ω-hydroxyalkylaminophenanthridines (**1**, **2**, **3**; Table II) (4), from the corresponding 6-chlorophenanthridines. The latter (**6**) (Table I) were prepared by refluxing the corresponding 6(5*H*)-phenanthridinones in an excess of phosphorus oxychloride with an equimolar amount of phosphorus pentachloride. The chloro derivatives deteriorate upon storage. High melting materials, presumably phenanthridinones, are formed with evolution of hydrogen chloride.

Compounds in series **1**, **2**, and **3** were prepared by reacting the hydroxyalkylamines with **6** in the presence of one equivalent of pyridine. Best results were obtained when **6** had not been stored more than a month after preparation. Although, as we recently reported, 2-aminoethanol is capable of reducing a nitro group to an amine (4), no such reduction was observed in the preparation of **2d** and **3d** using 3-amino-1-propanol and 2-amino-1-butanol.



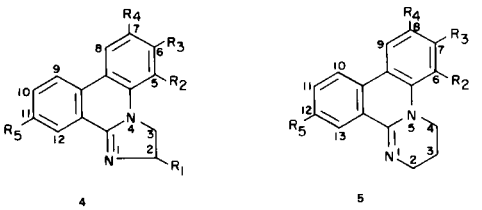
1 n = 2
2 n = 3

3

6

In attempting to prepare the *N*-nitroso derivatives of the **1**, **2**, and **3** series, we instead obtained dihydroimidazo (**4**) or tetrahydropyrimido (**5**) fused ring derivatives of phenanthridine by facile cyclization of the ω-carbon with the phenanthridine nitrogen (Table III).

This cyclization of the hydroxyalkylaminophenanthridines to the 2,3-dihydroimidazophenanthridines (**4**) and 1,2,3,4-tetrahydropyrimidophenanthridines (**5**) was accomplished by reaction of a sulfuric acid solution of **1**, **2**, or **3** with nitrosylsulfuric acid at 0-25°, for 2 hours, with subsequent basification with sodium hydroxide. Compounds **4** and **5** which are new ring systems, apparently unreported hitherto (5), are light yellow and markedly stable. They do not change upon prolonged refluxing, either in dimethyl sulfoxide (DMSO) with 10% sodium hydroxide, or in 6*N* hydrochloric acid in ethanol, or in 48% hydrobromic acid in acetic acid. The results of these latter two reactions, together with ir data, seem to eliminate the isomeric 6-aziridino- and 6-azetidino- structures from consideration.



4

5

The mechanism of this novel cyclization reaction is not entirely clear, but it would appear that during the nitrosation of the hydroxyalkylamines, *N*-nitrosoaminoalkylsulfates are formed, and these decompose during the alkaline treatment with elimination of ions as shown

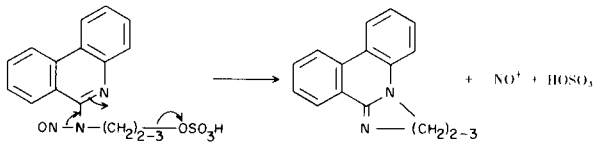
TABLE I

6-Chlorophenanthridines

Compound Number	R_1	R_2	R_3	R_4	Yield %	M.p., °C	Empirical Formula (Mol. wt.)	Calcd. C	Calcd. H	Calcd. N	Analyses, % X	Found C	Found H	Found N	Found X
6a	H	H	Br	H	100	162-163	$C_{13}H_7BrClN$(292.6)	53.37	2.41		27.31 (a) 12.12 (b)	53.17	2.53		27.22 (a) 12.08 (b)
6b	H	H	Cl	H	99	169-169.5	$C_{13}H_7Cl_2N$(248.1)	62.93	2.84		28.58 (b)	62.79	2.66		28.48 (b)
6c	Cl	H	Cl	H	88	205-206	$C_{13}H_6Cl_3N$(282.6)	55.26	2.14	4.96		55.36	2.09	4.95	
6d	H	Br	H	Br	87	213-215 dec. (c)	$C_{13}H_6Br_2ClN$(371.5)	42.02	1.63	3.77	9.54 (b)	41.87	1.76	3.75	9.33 (b)
6e	H	Cl	H	Cl	73	196-197 (d)	$C_{13}H_6Cl_3N$(282.6)	55.26	2.14	4.96		55.41	2.25	4.80	

(a) X = Br. (b) X = Cl. (c) Taken with block preheated to 213°. Lit. (8) m.p. 216-217°. (d) Lit. (8) m.p. 196-197°.

below, resulting in bond formation between the phenanthridine nitrogen and the alkyl carbonium ion.



The ir absorptions, measured for a representative compound of each series, are consistent with the structures assigned to **4** and **5**. The asymmetrical and symmetrical carbon-hydrogen stretching frequencies of the methylene groups in **4a** (2930 cm^{-1} and 2870 cm^{-1}), and in **4c** (2940 cm^{-1} and 2875 cm^{-1}), are considerably lower than would be expected in the strained ring system of aziridines. The latter generally absorb at around 3050 cm^{-1} (6a). The methylene scissoring frequencies of **4a** and **4c** are 1445 cm^{-1} and 1450 cm^{-1}. These again, are 25-30 cm^{-1} lower than the corresponding absorption of ethylenimine (6b). Likewise, the carbon-hydrogen stretching and scissoring frequencies of the methylene groups in **5c** are 2930 cm^{-1}, 2850 cm^{-1}, and 1440 cm^{-1}. These are characteristic absorptions for a strain-free cyclic compound. The spectra of **4a**, **4c**, and **5c** all showed a strong band at 1610-1620 cm^{-1} area indicating an isolated >C=N group. The >C=N absorption of 6-(2-hydroxyethyl)aminophenanthridine (**1a**) at 1605 cm^{-1} is weak, however, which is in agreement with the weak absorption of phenanthridine in this region (6c). The carbon-hydrogen stretching and scissoring frequencies of the methylene groups in **1a** are 2910 cm^{-1}, 2850 cm^{-1}, and 1425 cm^{-1} respectively.

Some of these compounds, **1b**, **4a**, **4b**, and **4c** have shown definite activity in cell culture testing against human epidermoid carcinoma of the nasopharynx; **2c** and **2d** have demonstrated slight activity against L-1210 lymphoid leukemia. For example, the maximum % T/C (survival time) for **2d** is 124% at 200 mg. (7).

EXPERIMENTAL

The ir spectra were run on a Beckman IR-33 in potassium bromide disks. Melting points below 250° were determined on a Fisher-Johns block and are corrected to standards. Those above 250° were taken in capillary tubes with a Hoover apparatus and are uncorrected. Analyses were performed by A. Bernhardt, Mikroanalytisches Laboratorium, Elbach über Engelskirchen, West Germany.

6-Chlorophenanthridines (**6**).

General Procedure.

The 6(5*H*)-phenanthridinone was mixed with equimolar phosphorus pentachloride and an excess of phosphorus oxychloride

TABLE II

6-(2-Hydroxyethyl)aminophenanthridines, 6-(3-Hydroxypropyl)aminophenanthridines and 6-[2-(1-Hydroxybutyl)]aminophenanthridines

Compound Number	R_1	R_2	R_3	R_4	Yield %	M.p., °C	Empirical Formula (Mol. wt.)	Analyses, % Calcd. C	H	N	X	Found C	H	N	X
1a	H	H	H	H	93	132-133	$C_{15}H_{14}N_2O$(238.3)			11.76				11.69	
1b	H	H	Br	H	100	178.5-179.5	$C_{15}H_{13}BrN_2O$(317.2)	56.80	4.13	8.83	25.19 (a)	56.97	4.29	8.96	25.28 (a)
1c	H	H	Cl	H	97	177-178	$C_{15}H_{13}ClN_2O$(272.7)			10.27	13.00 (b)			10.17	12.98 (b)
1d	Cl	H	Cl	H	100	199-200	$C_{15}H_{12}Cl_2N_2O$(307.2)	58.65	3.94	9.12	23.09 (b)	58.51	4.00	8.93	23.00 (b)
1e	H	Br	H	Br	90	210-211	$C_{15}H_{12}Br_2N_2O$(396.1)	45.49	3.05	7.07		45.51	2.97	7.16	
1f	H	Cl	H	Cl	88	179-180	$C_{15}H_{12}Cl_2N_2O$(307.2)	58.65	3.94	9.12		58.68	4.03	9.22	
2a	H	H	H	H	94	127.5-128.5	$C_{16}H_{16}N_2O$(252.3)	76.16	6.39	11.10		76.01	6.17	11.12	
2b	H	H	Br	H	100	166-167	$C_{16}H_{15}BrN_2O$(331.2)	58.02	4.56	8.46	24.13 (a)	57.83	4.65	8.56	24.09 (a)
2c	H	H	Cl	H	94	155-156	$C_{16}H_{15}ClN_2O$(286.8)	67.01	5.27	9.77		67.06	5.31	9.88	
2d	H	H	NO_2	H	98	200-201	$C_{16}H_{15}N_3O_3$(297.3)	64.64	5.09	14.13		64.70	5.00	14.30	
2e (c)	H	H	NH_2	H	90	210-212 dec. (d)	$C_{16}H_{17}N_3O\cdot 2HCl\cdot H_2O$ (358.3)	53.64	5.91	11.73	19.79 (b)	53.62	5.90	11.64	19.67 (b)
2f	NO_2	H	Br	H	100	170-170.5	$C_{16}H_{14}BrN_3O_3$(376.2)	51.08	3.75	11.17		51.13	3.78	11.01	
2g	NO_2	H	Cl	H	100	170-171	$C_{16}H_{14}ClN_3O_3$(331.8)	57.93	4.25	12.67		57.78	4.24	12.54	
2h	Cl	H	Cl	H	100	166.5-167.5	$C_{16}H_{14}Cl_2N_2O$(321.2)	59.83	4.39	8.72		59.89	4.36	8.65	
2i	H	Br	H	Br	98	240.5-241	$C_{16}H_{14}Br_2N_2O$(410.1)	46.86	3.44	6.83		46.83	3.25	6.83	
2j	H	Cl	H	Cl	97	210-211	$C_{16}H_{14}Cl_2N_2O$(321.2)	59.82	4.39	8.72		59.85	4.53	8.72	
3a (e)	H	H	H	H	68	202-204 dec.	$C_{17}H_{18}N_2O\cdot HBr$(347.3)	58.80	5.52	8.07	23.01 (a)	58.92	5.44	8.09	22.90 (a)
3b	H	H	Br	H	100	131-132	$C_{17}H_{17}BrN_2O$(345.3)	59.14	4.96	8.11		59.29	5.05	8.02	
3c	H	H	Cl	H	88	126.5-127.5	$C_{17}H_{17}ClN_2O$(300.8)			9.35				9.72	
3d	H	H	NO_2	H	100	163-164	$C_{17}H_{17}N_3O_3$(311.3)	65.59	5.50	13.50		65.46	5.42	13.35	
3e	Cl	H	Cl	H	92	175.5-176.5	$C_{17}H_{16}Cl_2N_2O$(335.2)	60.91	4.81	8.36		61.14	5.02	8.59	
3f	H	Br	H	Br	89	170-171	$C_{17}H_{16}Br_2N_2O$(424.2)	48.14	3.80	6.60		48.07	3.65	6.72	
3g	H	Cl	H	Cl	87	159-160	$C_{17}H_{16}Cl_2N_2O$(335.3)	60.91	4.81	8.36		60.70	4.66	8.48	

(a) X = Br. (b) X = Cl. (c) Dihydrochloride monohydrate. (d) Taken with a preheated block. The melt resolidified and did not melt at 350°. (e) Hydrobromide.

TABLE III

2,3-Dihydroimidazo[1,2-*f*]phenanthridines and 1,2,3,4-Tetrahydropyrimido[1,2-*f*]phenanthridines

Compound Number	R_1	R_2	R_3	R_4	R_5	Yield %	M.p., °C	Empirical Formula (Mol. wt.)	Analyses, % Calcd. C	H	N	X	Found C	H	N	X
4a	H	H	H	H	H	77	127.5-128.5	$C_{15}H_{12}N_2$(220.3)	81.79	5.49	12.72		81.98	5.53	12.44	
4b	H	H	H	Br	H	74	182-183	$C_{15}H_{11}BrN_2$(299.1)	60.24	3.71	9.37		60.01	3.81	9.26	
4c	H	H	H	Cl	H	88	188-189 dec.	$C_{15}H_{11}ClN_2$(254.7)	70.73	4.35			70.66	4.32		
4d	H	H	H	NO_2	H	97	257-258	$C_{15}H_{11}N_3O_2$(265.3)	67.92	4.18	15.84		68.03	3.93	15.98	
4e(a)	H	H	H	NH_2	H	75	211-213 (b)	$C_{15}H_{13}N_3 \cdot H_2O$(253.3)	71.12	5.97			71.48	5.63		
4f	H	NO_2	H	Br	H	10	165-166 (c)	$C_{15}H_{10}BrN_3O_2$(344.2)	52.35	2.93	12.21		52.23	2.92	12.38	
4g	H	Cl	H	Cl	H	50	178-179	$C_{15}H_{10}Cl_2N_2$(289.2)	62.30	3.48	9.70		62.11	3.28	9.60	
4h	H	H	Br	H	Br	70	249-250	$C_{15}H_{10}Br_2N_2$(378.1)	47.65	2.67	7.41	42.27 (e)	47.61	2.54	7.41	42.16 (e)
4i	H	H	Cl	H	Cl	79	254-255	$C_{15}H_{10}Cl_2N_2$(289.2)	62.30	3.48	9.70		62.13	3.36	9.66	
4j(d)	Et	H	H	Br	H	90	347-349 dec.	$C_{17}H_{15}BrN_2 \cdot HBr$(408.2)	50.03	3.95	6.86	39.16 (e)	49.87	3.96	6.78	39.07 (e)
4k(d)	Et	H	H	Cl	H	58	345-347 dec.	$C_{17}H_{15}ClN_2 \cdot HBr$(363.7)	56.14	4.44	7.70	21.97 (e) 9.75 (f)	56.09	4.36	7.83	22.09 (e) 9.83 (f)
4l	Et	H	H	NO_2	H	80	183-183.5	$C_{17}H_{15}N_3O_2$(293.3)	69.61	5.15	14.33		69.45	5.22	14.24	
4m(a)	Et	H	H	NH_2	H	57	125-126 dec. (g)	$C_{17}H_{17}N_3 \cdot H_2O$(281.4)	72.57	6.81	14.94		72.41	6.69	14.76	
4n	Et	Cl	H	Cl	H	82	144-145	$C_{17}H_{14}Cl_2N_2$(317.2)	64.37	4.45	8.83	22.35 (f)	64.25	4.33	8.74	22.19 (f)
4o(a)	Et	H	Br	H	Br	53	143-144	$C_{17}H_{14}Br_2N_2 \cdot H_2O$ (424.2)	48.14	3.80	6.60		48.28	3.88	6.51	
4p	Et	H	Cl	H	Cl	44	115-116	$C_{17}H_{14}Cl_2N_2$(317.2)	64.37	4.45	8.83		64.27	4.55	8.80	
5a(d)		H	H	H	H	38	>360	$C_{16}H_{14}N_2 \cdot HBr$(315.2)	60.97	4.80	8.89		60.92	4.89	8.73	
5b(d)		H	H	Br	H	67	345-347 dec.	$C_{16}H_{13}BrN_2 \cdot HBr$(394.1)	48.76	3.58	7.11	40.55 (e)	48.53	3.67	6.95	40.42 (e)
5c		H	H	Cl	H	64	125-126	$C_{16}H_{13}ClN_2$(268.8)	71.51	4.88	10.42		71.71	4.94	10.44	
5d		H	H	NO_2	H	54	267.5-268.5 dec.	$C_{16}H_{13}N_3O_2$(279.3)	68.81	4.69	15.05		68.64	4.66	14.93	
5e		H	H	NHAc	H	30	243-244 (h)	$C_{18}H_{17}N_3O$(291.4)	74.20	5.88	14.42		73.99	5.74	14.57	
5f(d)		H	Br	H	Br	54	>360	$C_{16}H_{12}Br_2N_2 \cdot HBr$(473.0)	40.63	2.77	5.92	50.68 (e)	40.59	2.66	5.85	50.48 (e)
5g		H	Cl	H	Cl	61	178.5-179.5	$C_{16}H_{12}Cl_2N_2$(303.2)	63.38	3.99	9.24		63.51	4.12	9.13	

(a) Monohydrate. (b) Melted with evolution of gas at <190°. The melt resolidified and remelted at 211-213°. (c) Melted at <135°; the melt resolidified and remelted at 165-166°. (d) Hydrobromide. (e) X = Br. (f) X = Cl. (g) Taken with block preheated at 124°. The melt resolidified upon further heating and gradually remelted at 198°. (h) Taken with block preheated at 242°. The melt resolidified when pressed.

(100-250 ml. per 0.1 mole of the phenanthridinone). The mixture was refluxed for 24-48 hours and the phosphorus oxychloride was distilled off and recovered for further use. The product was triturated with a mixture of crushed ice and water, until all the residual phosphorus oxychloride had been destroyed, and then was collected on a filter, washed with water, dried, and recrystallized from benzene-ligroin (d, 0.68-0.70). Thus, 19.5 g. (0.1 mole) of 6(5*H*)-phenanthridinone, 20.8 g. of phosphorus pentachloride, and 120 ml. of phosphorus oxychloride gave 19.3 g. (91%) of 6-chlorophenanthridine, m.p. 117.5-118.5° (lit. m.p. 116°) (9).

6-(2-Hydroxyethyl)aminophenanthridines (**1**), 6-(3-Hydroxypropyl)aminophenanthridines (**2**), and 6-[2-(1-Hydroxybutyl)]aminophenanthridines (**3**) (Except **2e**).

General Procedure.

The 6-chlorophenanthridine (**6**) [or a previously reported derivative (4)] was mixed with excess 2-aminoethanol, or 3-amino-1-propanol, or 2-amino-1-butanol (100-250 ml. per 0.1 mole of **6**) and one equivalent of pyridine. The mixture was heated under reflux with stirring at 105-110° for 24-48 hours (1-2 hours on a steam bath for **2d**, **2f**, and **2g**), cooled, and stirred into hot water. The product separated either as a solid or as an oil. If crystalline, it was filtered off, washed with water, dried, and recrystallized from ethanol-water, ethanol, or benzene; if oily, it was extracted into benzene. After evaporation of the water-washed and dried (sodium sulfate) benzene solution the oil was treated with 48% hydrobromic acid (35 g. per 0.1 mole of the amine). The mixture was then dissolved in 95% ethanol and filtered. The filtrate was boiled to a small volume and cooled. The precipitated amine hydrobromide was recrystallized from water.

2-Amino-6-(3-hydroxypropyl)aminophenanthridine Dihydrochloride Monohydrate (**2e**).

6-(3-Hydroxypropyl)amino-2-nitrophenanthridine (**2d**) (3 g., 0.01 mole), 95% ethanol (100 ml.), 99% hydrazine hydrate (2 ml.), and 5% palladium on carbon (0.1 g.) were refluxed for 1.5 hours and filtered hot. The filtrate was evaporated to a small volume and water was added until an oil started to separate. It was cooled and the oil was separated, water-washed by decantation, and dissolved in acetone (100 ml.). The amine was precipitated as the hydrochloride salt by addition of concentrated hydrochloric acid. The amine hydrochloride was filtered off, washed several times with acetone and recrystallized from water.

2,3-Dihydroimidazo[1,2-*f*]phenanthridines (**4**), 2,3-Dihydro-2-ethylimidazo[1,2-*f*]phenanthridines (**4**), and 1,2,3,4-Tetrahydropyrimido[1,2-*f*]phenanthridines (**5**) (Except **4e**, **4m**, and **5e**).

General Procedure.

A solution of **1**, **2**, or **3** in concentrated sulfuric acid (25-50 ml. per 0.01 mole of the hydroxyalkylamine) was cooled to $<5°$. To the stirred solution nitrosylsulfuric acid, prepared from 3 equivalents of sodium nitrite and concentrated sulfuric acid (15 ml. per 0.03 mole of sodium nitrite), was added in one portion. The mixture was continuously stirred at 0-5° for 1 hour and then the cooling bath was removed. The reaction mixture was stirred at ambient temperature for an additional hour and poured into an ice-water mixture. The suspension was strongly basified with dilute sodium hydroxide, heated with stirring to 65-85° and cooled. The crude product, if solid, was collected by filtration, washed well with water, dried and recrystallized from methanol, ethanol, methanol-water, ethanol-water, or benzene; if the product was oily or gummy, it was taken up in benzene. The benzene solution was washed with water, dried over anhydrous magnesium sulfate, and the solvent evaporated. The residual oily material was dissolved in acetic acid (15-20 ml. per 10 g. of the product). The solution was heated to near boiling and 48% aqueous hydrobromic acid ($\sim$20 ml. per 10 g. of the phenanthridine) was added. The hot solution soon deposited glistening white needles which were collected on a filter, washed with a little acetic acid and recrystallized from water.

7-Amino-2,3-dihydroimidazo[1,2-*f*]phenanthridine Monohydrate (**4e**).

7-Nitro-2,3-dihydroimidazo[1,2-*f*]phenanthridine (**4d**) (4.7 g., 0.018 mole) was reduced as described in the preparation of **2e** with 5% Pd/C (0.3 g.) and 99% hydrazine hydrate (5 ml.) in 95% ethanol (150 ml.) and toluene (100 ml.). The crude product was recrystallized from ethanol-water giving 3.4 g. of glistening yellow needles.

7-Amino-2-ethyl-2,3-dihydroimidazo[1,2-*f*]phenanthridine Monohydrate (**4m**).

2-Ethyl-7-nitro-2,3-dihydroimidazo[1,2-*f*]phenanthridine (**4l**) (1.5 g., 5 mmoles) was reduced as just described for **4e**. The product was recrystallized from methanol-water giving 0.8 g. of yellow rhombic crystals.

8-Acetamido-1,2,3,4-tetrahydropyrimido[1,2-*f*]phenanthridine (**5e**).

8-Nitro-1,2,3,4-tetrahydropyrimido[1,2-*f*]phenanthridine (**5d**) (1 g., 3.6 mmoles) was reduced as described previously with 5% Pd/C (0.1 g.) and 99% hydrazine hydrate (5 ml.) in 95% ethanol (200 ml.). The crude amine (0.5 g.) was mixed with acetic acid (25 ml.), water (12 ml.), and acetic anhydride (2.5 ml.). The mixture was shaken for 15 minutes, heated on a steam bath for another 15 minutes and cooled. The light yellow solution was diluted with water (10 ml.) and the solvents were boiled off. The residual oil, which solidified upon drying over phosphorus pentoxide in a vacuum, was water-soluble, and weighed 0.9 g. The solid was dissolved in water (22 ml.) and 5% sodium hydroxide was added until a *p*H of 9-10 was obtained. The precipitated solid was separated and recrystallized from ethanol-water giving 0.6 g. of glistening needles.

Attempted Hydrolysis of 2,3-Dihydroimidazo[1,2-*f*]phenanthridine (**4a**).

Compound **4a** (0.7 g.) was refluxed in a mixture of acetic acid (20 ml.) and 48% hydrobromic acid (5 ml.) for 15 hours and then the solvent was distilled off. The residual hydrobromide was recrystallized from acetic acid giving 0.5 g., m.p. $>330°$. Treatment with dilute alkali gave an oil which solidified upon drying. Tlc as well as melting point and mixture melting point showed that this material and **4a** are the same.

Attempted Hydrolysis of 7-Bromo-2,3-dihydroimidazo[1,2-*f*]phenanthridine (**4b**).

a. With 6*N* Hydrochloric Acid in Ethanol.

Compound **4b** (0.6 g.) was dissolved in a mixture of 95% ethanol (100 ml.) and 6*N* hydrochloric acid (50 ml.). The solution was refluxed for 70 hours and the solvent was distilled off. The yellowish residue was triturated in dilute ammonium hydroxide and the yellowish solid was filtered off, washed with water and dried giving 0.6 g. of unreacted **4b** as indicated by melting point and mixture melting point.

b. With 10% Sodium Hydroxide in DMSO.

Compound **4b** (0.6 g.) was dissolved in DMSO (25 ml.) by

warming. To the warm solution 10% aqueous sodium hydroxide (15 ml.) was added. The mixture was gently refluxed with stirring for 24 hours and cooled. The yellowish needles (0.4 g.) were filtered off, washed with water and dried; melting point and mixture melting point, 181-183°, indicated that **4b** was unchanged.

Hydrolysis of 6-(2-Hydroxyethyl)amino-2-nitrophenanthridine to 2-Nitro-6(5*H*)-phenanthridinone with 10% Aqueous Sodium Hydroxide in DMSO.

A solution of 6-(2-hydroxyethyl)amino-2-nitrophenanthridine (4) (0.5 g.) in DMSO (25 ml.) was heated on a steam bath with 10% aqueous sodium hydroxide (10 ml.) for 24 hours and then diluted with water. The precipitate was collected by filtration and washed with water giving 0.4 g. of 2-nitro-6(5*H*)-phenanthridinone, melting point and mixture melting point: 381-383° (lit. m.p. 382-283°) (10).

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