Pyrimidines. Part 53.[1] Novel Ring Transformation induced by the Substituent Effect of the Phenyl Group. Reaction of 5-Bromo-6-methyl-1-phenyluracil Derivatives with Amines and Hydrazine to give Hydantoins and Pyrazolones[2]

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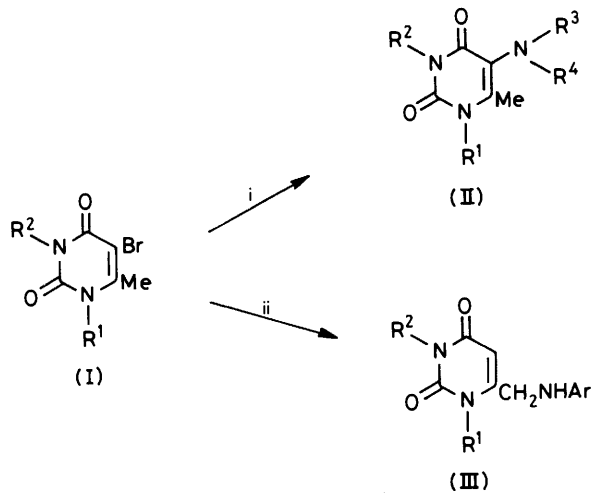
Reaction of 5-bromo-6-methyluracil derivatives (**1**), possessing a phenyl or *para*-substituted phenyl group at the 1-position of the uracil ring, with methylamine and hydrazine hydrate causes novel ring transformations to give 1-arylhydantoins (**2**) and 4-ureidopyrazol-3-ones (**9**), respectively. The latter conversion into the pyrazolone (**9**) is a double ring transformation *via* a hydantoin intermediate (**IV**).

The chemical properties of 6-unsubstituted 5-halogenouracil derivatives, which show interesting behaviour towards soft nucleophiles such as SO_3^{2-} and CN^-, have been well investigated,[3] whereas little work has appeared on the reactivity of 5-halogeno-6-methyluracil derivatives.[4] Previously, we investigated the reaction of 5-bromo-6-methyluracils (**I**) with a variety of amines in order to prepare analgesic uracil derivatives, and reported that the reaction of the uracils (**I**) with arylamines caused an abnormal nucleophilic substitution on the 6-methyl group to give the corresponding 6-(arylaminomethyl)-uracils (**III**)[5] although the reaction with dialkylamines afforded the corresponding 5-(dialkylamino)uracils (**II**)[6] (Scheme 1).

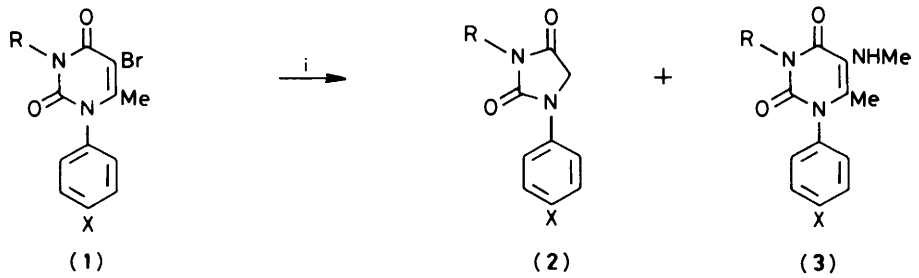
Our continuing interest in the properties of 5-bromo-6-methyluracils has prompted us to undertake a study of the reaction with other nucleophiles such as primary alkylamines and hydrazines. When 1-aryl-5-bromo-6-methyluracil derivatives (**1**) were used as starting materials, we found that a new type of ring transformation of the uracil occurred to give hydantoin and pyrazolone ring systems.



Scheme 1. *Reagents:* i, R^3R^4NH; ii, $ArNH_2$

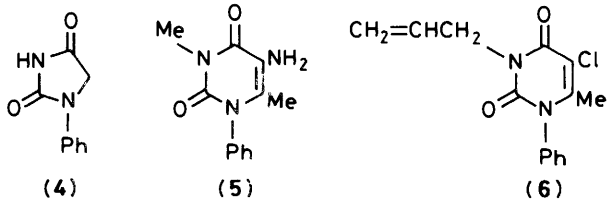
Results and Discussion

Reaction with Primary Amines.—Treatment of 5-bromo-3,6-dimethyl-1-phenyluracil (**1a**) with 30% aqueous methylamine in dimethylformamide (DMF) using a sealed tube at 100 °C for 18 h resulted in the formation of a ring-contraction product, 3-methyl-1-phenylhydantoin (**2a**) (30%), and a normal substitution product, 3,6-dimethyl-5-(methylamino)-1-phenyluracil (**3a**) (21%). The structure of compound (**2a**) was confirmed by direct comparison with an authentic sample[7] prepared by methylation of 1-phenylhydantoin (**4**) according to the modified method of Biltz and Slotta.[7] Similar reaction of 5-bromo-6-methyluracils (**1b—e**), bearing a phenyl or *para*-substituted phenyl group at the 1-position, with methylamine gave the corresponding hydantoin derivatives (**2b—e**) in 19—36% yield



	R	X
a;	Me	H
b;	Me	Cl
c;	Me	OMe
d;	Et	H
e;	$CH_2CH{=}CH_2$	H
f;	Bu	H

Reagents: i, $MeNH_2$



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together with the uracils (**3b**) and (**3c**) as shown in Table 1. Other 5-(methylamino)uracils (**3d**) and (**3e**) were detected in the respective crude products by u.v. and n.m.r. spectra but could not be isolated in pure form. Their structures were established by microanalytical and spectral data (Table 2).

When the 5-bromouracil (**1a**) was treated with ethylamine instead of methylamine, the same product (**2a**) was formed though its yield was low. The reaction with ammonia, however, afforded the corresponding 5-aminouracil (**5**) and the reaction with tertiary amines such as triethylamine resulted in recovery of the starting material. In the latter two reactions we were unable to detect the hydantoin (**2a**) in the reaction mixture. Upon treatment of the 5-bromouracil (**1a**) with dialkylamines and aromatic amines, no ring contraction occurred but, instead, alternative reactions gave 5-(dialkylamino)uracils (**II**) and 6-(arylaminomethyl)uracils (**III**), respectively, as reported previously [5,6]

Substituent effects at the 1-, 3-, 5-, and 6-position were examined. The uracil (**6**), having a 5-chloro group, was allowed to react with methylamine under the same conditions, and afforded the hydantoin (**2e**) (84%) as the sole product. This result indicates that the ring contraction occurs in preference to the formation of the 5-(methylamino)uracil (**3e**) because a chloro group is generally less active towards nucleophilic substitution by amines than is a bromo group. On the other hand, the 5-bromo-1-phenyluracil derivatives (**7a**) and (**7b**), lacking either a 3-substituent or 6-methyl group respectively, and the 5-bromo-3-phenyluracil derivative (**7c**) reacted with methylamine to give normal displacement products, 5-(methylamino)uracils (**8a**—**c**), respectively. These results suggest that a 1-phenyl substituent facilitates cleavage of the 1,6-bond, leading to ring contraction, and the lack of the 6-methyl group accelerates the replacement by the amine at the 5-position because of reduced steric hindrance.

On the basis of the above facts, a plausible reaction mechanism for the ring transformation to the hydantoin ring system is shown in Scheme 2. Initial nucleophilic addition of methylamine to the 5,6-double bond and subsequent cleavage of the 1,6-bond are followed by ring closure to afford a hydantoin intermediate (**IV**). A tautomer (**V**) of the intermediate (**IV**) is subjected to aminolysis to give the final product (**2**). The possibility of hydrolysis instead of such an aminolysis was ruled out on the basis of the following experimental result. The reaction of compound (**1a**) with methylamine under anhydrous conditions was attempted since we expected to isolate the intermediate (**IV**; R = Me, X = H), but this could not be obtained and compounds (**2a**) and (**3a**) were formed. This fact indicates that there is no participation of water in the reaction.

Reaction with Hydrazine Hydrate.—When the 5-bromouracil (**1a**) and excess of hydrazine hydrate in propan-2-ol were heated under reflux for 24 h, another ring transformation occurred to

Table 1. The reaction of 5-halogenouracils with amines

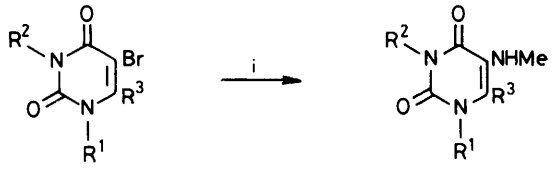
5-Halogenouracil	Amine	Product	M.p. (°C)	Recrystallization solvent	Yield (%)
(**1a**)	$MeNH_2$	(**2a**)	192[a]	MeOH	30
		(**3a**)	124	*b*	21
(**1b**)	$MeNH_2$	(**2b**)	172	*b*	36
		(**3b**)	158	*b*	22
(**1c**)	$MeNH_2$	(**2c**)	198[c]	AcOEt	36
		(**3c**)	164	MeOH-water	4
(**1d**)	$MeNH_2$	(**2d**)	149	AcOEt	23
(**1e**)	$MeNH_2$	(**2e**)	124	*b*	19
(**6**)	$MeNH_2$	(**2e**)	124	*b*	84
(**1a**)	$EtNH_2$	(**2a**)	192	MeOH	16
(**1a**)	NH_3	(**5**)	251	MeOH	33
(**7a**)	$MeNH_2$	(**8a**)	236	Benzene	17
(**7b**)	$MeNH_2$	(**8b**)	163	EtOH	67
(**7c**)	$MeNH_2$	(**8c**)	152	water	34

[a] Lit.[7] 185 °C. [b] Light petroleum (boiling range 75—120 °C). [c] Lit.,[7] 194 °C.

Table 2. Spectral and analytical data of hydantoins (**2**)

Compound	$\nu_{max.}$/cm^{-1} (C=O)	$\lambda_{max.}$ (EtOH)/nm (ε/dm^3 mol^{-1} cm^{-1})	δ_H[a] (5-H_2)	Formula	Found (Requires) C	H	N
(**2a**)	1 770	233sh (8 300), 247 (11 000)	4.26	$C_{10}H_{10}N_2O_2$	63.35	5.55	14.7
	1 705	272sh (2 200), 281 (1 200)			(63.15	5.3	14.75)[b]
(**2b**)	1 765	, 252 (16 600)	4.29	$C_{10}H_9ClO_2$	53.3	3.95	12.6
	1 700	282sh (1 600), 291 (900)			(53.45	4.05	12.45)
(**2c**)	1 760	238 (10 500), 252 (10 200)	4.27	$C_{11}H_{12}N_2O_3$	60.1	5.4	12.7
	1 705	288sh (2 700), 299sh (1 600)			(60.0	5.5	12.7)[b]
(**2d**)	1 760	233sh (8 500), 247 (11 000)	4.30	$C_{11}H_{12}N_2O_2$	64.6	6.0	13.7
	1 705	272sh (2 400), 281 (1 300)			(64.7	6.0	13.7)
(**2e**)	1 770	232sh (9 800), 246 (12 600)	4.33	$C_{12}H_{12}N_2O_2$	66.75	5.65	12.9
	1 710	273sh (2 300), 280 (1 400)			(66.65	5.6	12.95)

[a] $CDCl_3$ solution. [b] Calculated values for known compound.



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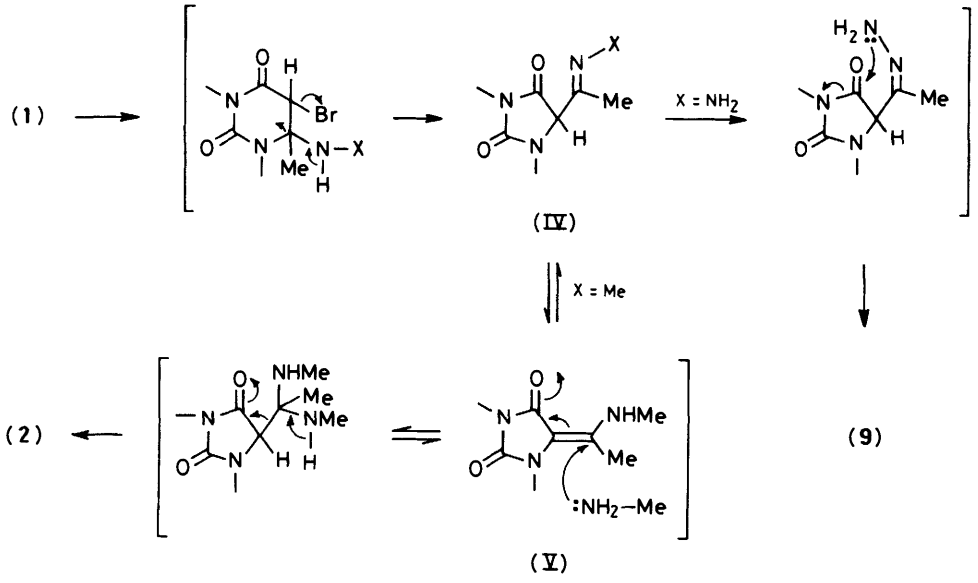
	R^1	R^2	R^3
a;	Ph	H	Me
b;	Ph	Me	H
c;	Me	Ph	Me

Reagents: i, $MeNH_2$

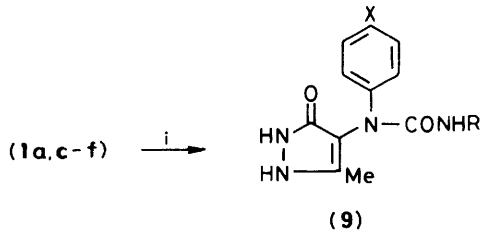
with sodium borohydride in pyridine to give amines and formamides.[10] Accordingly, compound (**9a**) was subjected to reduction with sodium borohydride–pyridine and was converted into the 4-anilinopyrazolone (**10**), which was identical with the authentic sample obtained above.

The ring transformation of the uracil (**1a**) to the pyrazolone (**9a**) was applicable to other 5-bromo-6-methyluracils (**1c—f**) bearing a phenyl or *para*-substituted phenyl group at the 1-position. Treatment of the uracils (**1c—f**) with hydrazine hydrate under the same conditions gave the corresponding pyrazolone derivatives (**9c—f**) in good yield (see Table 3). The structures of the products (**9c—f**) were confirmed by their elemental and spectroscopic analyses. In particular, their mass spectrum showed an intense base peak corresponding to 4-



Scheme 2.

furnish 5-methyl-4-(3-methyl-1-phenylureido)pyrazol-3(2H)-one (**9a**) in 89% yield as the sole product. The structure of compound (**9a**) was supported by its elemental analysis and spectroscopic data. Since another possible structure, 5-methyl-3-methylamino-4-phenyl-1,4-dihydro-1,2,4-triazine-6-carboxylic



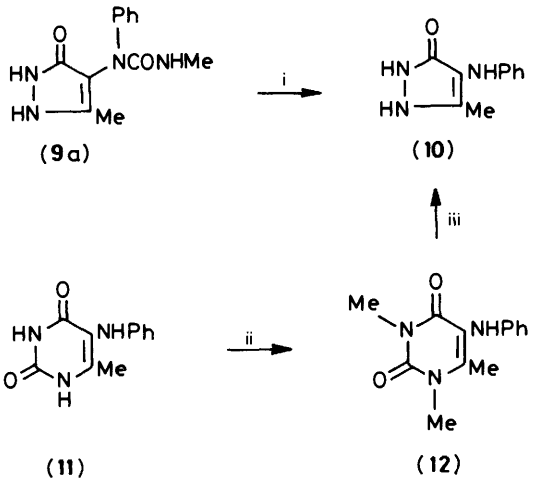
Reagents: i, $NH_2NH_2 \cdot H_2O$

acid (**13**; R = Me, X = H), could be considered,* an alternative synthesis of compound (**9a**) for eventual comparison with the transformation product was attempted. Thus, methylation of 5-anilino-6-methyluracil (**11**)[8] with dimethyl sulphate afforded 5-anilino-1,3,6-trimethyluracil (**12**), which was treated with hydrazine hydrate to give 4-anilino-5-methylpyrazole-3(2H)-one (**10**) *via* a well known ring transformation[9] (Scheme 3). Reaction of the pyrazolone (**10**) with methyl isocyanate under various conditions, however, failed to give the expected product (**9a**). It has been shown that *NNN'*-trisubstituted ureas are reduced anilinopyrazolones (*M* − RNCO). On the other hand, analogous ring contraction of other 5-halogenouracil derivatives such as the 5-bromouracils (**7a—c**), 5-bromo-1,3,6-trimethyluracil, 5-chloro-3-methyl-1-phenyluracil, were carried out under various conditions, but the corresponding pyrazolones were not obtained; instead, the reactions gave a decomposition product, *N*-methyl-*N'*-phenylurea, or a complicated mixture of products.

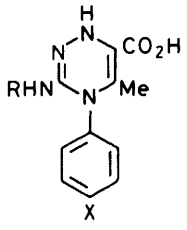
A reasonable mechanism for the transformation of the uracil (**1**) to the pyrazolone (**9**) is outlined in Scheme 2 (see above). A key intermediate (**IV**; X = NH_2) could be similarly formed according to the sequence for the formation of the hydantoin (**2**). The intermediate (**IV**) subsequently undergoes an intramolecular nucleophilic attack of the terminal amino group on the 4-carbonyl group to give the pyrazolones (**9**). This double ring transformation differs from a well known uracil-to-pyrazolone transformation[9] in terms of reaction mechanism.

Furthermore, reaction of the 5-bromouracil (**1a**) with methylhydrazine in refluxing propan-2-ol yielded a slight amount of 5-

* Previously we had presented the incorrect structure (**13**) for the ring-transformation product (**9**) at the 8th Congress of Heterocyclic Chemistry (Japan) [S. Senda, K. Hirota, K. Banno, T. Asao, J. Haruta, and Y. Yamada, Congress of Heterocyclic Chemistry (Kyoto), 8th, 1975, Abstracts of papers p. 149 (*Chem. Abstr.*, 1976, **84**, 164715); *Heterocycles*, 1975, **3**, 1128; see also: H. C. van der Plas and J. W. Streef, 'Aromatic and Heteroaromatic Chemistry,' eds C. W. Bird and G. W. H. Cheeseman, The Chemical Society, London, 1977, vol. 5, p. 257].



Scheme 3. *Reagents:* i, $NaBH_4$; ii, Me_2SO_4; iii, $NH_2NH_2{\cdot}H_2O$



photometer. ^1H N.m.r. spectra were determined with a Hitachi Perkin-Elmer R-20B (60 MHz) instrument for solutions in $(CD_3)_2SO$ unless otherwise stated, using tetramethylsilane as internal standard. Chemical shifts are reported in p.p.m. (δ) and signals are quoted as s (singlet), d (doublet), t (triplet), q (quartet), m (multiplet), br (broad); *J* values are first order. Mass spectra were taken on a JEOL JMS-D300 machine operating at 70 eV.

Reaction of N-*substituted* 5-*Bromouracils* (**1a—e**) *with Amines. General Procedure* (*Table 1*).—A mixture of the 5-halogenouracil[6,11] (**1a—e**), (**6**), or (**7a—c**) (10 mmol) and an aqueous solution of methylamine, ethylamine, or ammonia (50 mmol) in DMF (10 ml) was heated in a sealed tube at 100 °C for 18 h. The reaction mixture was treated as described below unless otherwise stated. The solvent was removed under reduced pressure and the residue was triturated with ether and water to give the *hydantoin* (**2**), the 5-*aminouracil* (**5**), or the 5-(*methylamino*)*uracil* (**8**). The ethereal filtrate was evaporated under reduced pressure and chromatographed on activated alumina with ether as eluant to give the 5-(*methylamino*)*uracil* (**3b**) and (**3c**). The products thus obtained were purified by recrystallization from an appropriate solvent as shown in Table 1.

3-*Methyl*-1-*phenylhydantoin* (**2a**) *and* 3,6-*Dimethyl*-5-*methylamino*-1-*phenyluracil* (**3a**). The reaction mixture was kept overnight. The resulting precipitate was filtered off to give the hydantoin (**2a**). The mother liquor was evaporated under reduced pressure and water was added to the residue. The mixture was extracted with chloroform and the extract was evaporated. The residue was distilled under reduced pressure (b.p. 165—170 °C/0.2 mmHg) to give the crude 5-(*methylamino*)*uracil* (**3a**); δ_H ($CDCl_3$) 1.94 (3 H, s, 6-Me), 2.64 (3 H, s, NH*Me*), 3.43 (3 H, s, 3-Me), and 7.15—7.68 (5 H, m, Ph); $\lambda_{max.}$ 216 (ε 10 200 dm^3 mol^{-1} cm^{-1}) and 282 nm (6 200); $\nu_{max.}$ 1 690 (CO) and 3 360 cm^{-1} (NH) (Found: C, 63.65; H, 6.1; N, 17.2. $C_{13}H_{15}N_3O_2$ requires C, 63.65; H, 6.15; N, 17.15%).

Table 3. 4-(3-Alkyl-1-arylureido)-5-methylpyrazol-3-ones (**9**)

Compound	R	X	Recrystallization solvent	M.p. (°C)	Yield (%)	Formula	Found (Requires) (%) C	H	N
(**9a**)	Me	H	EtOH–ether	254	89	$C_{12}H_{14}N_4O_2$	58.4 (58.5	5.75 5.75	22.7 22.75)
(**9c**)	Me	OMe	Pr^{i}OH	256—257	57	$C_{13}H_{16}N_4O_3$	56.4 (56.5	5.8 5.85	20.2 20.3)
(**9d**)	Et	H	Pr^{i}OH	245—246	75	$C_{13}H_{16}N_4O_2$	59.8 (60.0	6.2 6.2	21.55 21.55)
(**9e**)	$CH_2CH{=}CH_2$	H	Pr^{i}OH	238—239	59	$C_{14}H_{16}N_4O_2$	61.45 (61.75	5.95 5.9	20.5 20.6)
(**9f**)	Bu	H	Pr^{i}OH	228—229	73	$C_{15}H_{20}N_4O_2$	62.5 (62.5	7.05 7.0	19.45 19.45)

amino-3,6-dimethyl-1-phenyluracil (**5**) together with recovery of most of the starting material (**1a**). Heating compound (**1a**) without any solvent at 100 °C improved the yield of the product (**5**). However, a mechanism for the formation of compound (**5**) is still uncertain. When compound (**1a**) was treated with phenylhydrazine under the same conditions, practically no reaction took place and most of the starting material (**1a**) was recovered unchanged.

As a result of these investigations, we conclude that substitution of phenyl groups at the 1-position of uracils has a great influence on the occurrence of both ring contractions of the uracils (**1**) to the hydantoins (**2**) and to the pyrazolones (**9**).

Experimental

M.p.s were taken on a Yanagimoto melting-point apparatus and are uncorrected. I.r. spectra were recorded with a Hitachi Model 215 spectrophotometer using KBr pellets. U.v. spectra were obtained from ethanol solutions on a Hitachi 323 spectro-

1-(p-*Chlorophenyl*)-3,6-*dimethyl*-5-(*methylamino*)*uracil* (**3b**). (Found: C, 55.8; H, 5.05; N, 15.05. $C_{13}H_{14}ClN_3O_2$ requires C, 55.8; H, 5.05; N, 15.0%).

1-(p-*Methoxyphenyl*)-3,6-*dimethyl*-5-(*methylamino*)*uracil* (**3c**). δ_H 1.97 (3 H, s, 6-Me), 2.64 (3 H, s, NH*Me*), 3.17 (1 H, br, NH), 3.43 (3 H, s, 3-Me), 3.88 (3 H, s, OMe), and 6.90—7.42 (4 H, m, C_6H_4) (Found: C, 61.3; H, 6.35; N, 15.05. $C_{14}H_{17}N_3O_3$ requires C, 61.1; H, 6.2; N, 15.25%).

3-*Allyl*-1-*phenylhydantoin* (**2e**). (*a*) The reaction mixture was evaporated under reduced pressure and the residue was subjected to column chromatography on silica gel with chloroform as eluant to give the *hydantoin* (**2e**).

(*b*) A mixture of the 5-chlorouracil (**6**) (0.9 g, 3.2 mmol) and 30% aqueous methylamine (2.0 ml, 20 mmol) in DMF (10 ml) was treated as described in the General Procedure. The reaction

mixture was evaporated under reduced pressure and water was added to the residue. The resulting precipitate was filtered off and recrystallized from light petroleum (b.p. 75—120 °C) to give leaflets (0.59 g, 84%), m.p. 124 °C; this product was identical with compound (**2e**) prepared above.

5-Amino-3,6-dimethyl-1-phenyluracil (**5**). δ_H 1.73 (3 H, s, 6-Me), 3.25 (3 H, s, 3-Me), 4.03 (2 H, br, NH_2, deuterium exchangeable), and 7.22—7.61 (5 H, m, Ph); $\lambda_{max.}$ 299 nm (Found: C, 62.55; H, 5.8; N, 18.2. $C_{12}H_{13}N_3O_2$ requires C, 62.3; H, 5.65; N, 18.15%).

6-Methyl-5-methylamino-1-phenyluracil (**8a**). δ_H ($CDCl_3$) 1.94 (3 H, s, 6-Me), 2.63 (3 H, s, NH*Me*), 3.01 (1 H, br, 5-NH, deuterium exchangeable), 7.16—7.59 (5 H, m, Ph), and 9.40 (1 H, br, 3-H, deuterium exchangeable) (Found: C, 62.4; H, 5.75; N, 17.85. $C_{12}H_{13}N_3O_2$ requires C, 62.3; H, 5.65; N, 18.15%).

3-Methyl-5-Methylamino-1-phenyluracil (**8b**). δ_H ($CDCl_3$) 2.72 (3 H, s, NH*Me*), 3.45 (3 H, s, 3-Me), 3.78 (1 H, br, NH, deuterium exchangeable), 6.32 (1 H, s, 6-H), and 7.46 (5 H, s, Ph) (Found: C, 62.2; H, 5.6; N, 18.2%).

1,6-Dimethyl-5-methylamino-3-phenyluracil (**8c**). δ_H ($CDCl_3$) 2.37 (3 H, s, 6-Me), 2.60 (3 H, s, NH*Me*), 3.21 (1 H, br, NH, deuterium exchangeable), 3.43 (3 H, s, 1-Me), and 7.16—7.58 (5 H, m, Ph); $\lambda_{max.}$ 293.5 nm (Found: C, 63.5; H, 6.4; N, 17.5. $C_{13}H_{15}N_3O_2$ requires C, 63.65; H, 6.15; N, 17.15%).

5-Amino-3,6-dimethyl-1-phenyluracil (**5**)—A mixture of the uracil (**1a**) (1.5 g, 5 mmol) and methylhydrazine (5 ml) was heated at 100 °C for 2.5 h. After the mixture had cooled, the resulting precipitate was collected by filtration to give the 5-aminouracil (**5**) (450 mg, 39%), which was identical with the product obtained from the reaction of compound (**1a**) with ammonia.

Alternative Synthesis of 3-Methyl-1-phenylhydantoin (**2a**).—*1-Phenylhydantoin* (**4**). A mixture of chloroacetyl chloride (5.5 g) and phenylurea (6.8 g) in DMF (40 ml) was kept overnight and then heated at 70 °C for 2 h. The solvent was removed under reduced pressure and the residue was triturated with water to give a crude product. Recrystallization from methanol gave *N*-chloroacetyl-*N*-phenylurea (5.0 g, 47%), m.p. 163—166 °C. The urea (5.0 g) was added to a solution of KOH (7 g) and water (7 ml) in ethanol (80 ml). The mixture was heated at 80 °C for 30 min. After being cooled, the reaction solution was acidified with HCl and evaporated under reduced pressure. The resulting precipitate was collected by filtration, washed with water, and recrystallized from ethanol to give the *hydantoin* (**4**) (3.0 g, 72%) as needles, m.p. 203 °C (Found: C, 61.4; H, 4.85; N, 15.6. $C_9H_8N_2O_2$ requires C, 61.35; H, 4.6; N, 15.9%).

3-Methyl-1-phenylhydantoin (**2a**). The hydantoin (**4**) (1.7 g, 10 mmol) was dissolved in a solution of KOH (1.7 g) in water (30 ml) and then dimethyl sulphate (2.4 g) was added dropwise to the stirred mixture. The resulting precipitate was filtered off and recrystallized from methanol to give the hydantoin (**2a**) as needles (1.5 g, 79%), m.p. 191 °C (lit.,[7] m.p. 185 °C). This product was identical with compound (**2a**) obtained by the ring-transformation reaction of the uracil (**1a**).

4-(3-Alkyl-1-arylureido)-5-methylpyrazol-3-ones (**9a—e**). *General Procedure.*—A solution of the bromouracil (**1a**) or (**1c—f**) (5 mmol) and hydrazine hydrate (2.5 g, 50 mmol) in propan-2-ol (50 ml) was refluxed for 24 h. The solvent was removed under reduced pressure. Ethyl acetate (50 ml) was added to the residue and the mixture was heated to reflux. After the mixture had cooled, the precipitate was filtered off and recrystallized from an appropriate solvent (see Table 3).

5-Methyl-4-(3-methyl-1-phenylureido)pyrazol-3(2H)-one (**9a**). δ_H 2.00 (3 H, s, 5-Me), 2.61 (3 H, d, *J* 4.5 Hz, NH*Me*, collapsed to singlet by deuterium exchange), 5.98 (1 H, br, NH, deuterium exchangeable), and 7.00—7.40 (5 H, m, Ph); *m/z* 246 (M^+) and 189 (M − MeNCO, base peak); $\lambda_{max.}$ 242 nm (ε 10 700 dm^3 mol^{-1} cm^{-1}).

4-[1-(p-Methoxyphenyl)-3-methylureido]-5-methylpyrazol-3(2H)-one (**9c**). δ_H 1.98 (3 H, s, 5-Me), 2.55 (3 H, d, *J* 4.5 Hz, NMe, collapsed to singlet by deuterium exchange), 3.71 (3 H, s, OMe), 5.77 (1 H, br, NH, deuterium exchangeable), and 6.77 and 7.15 (each 2 H, each d, each *J* 8 Hz, C_6H_4); *m/z* 276 (M^+) and 219 (M − *p*-$MeOC_6H_4NCO$, base peak); $\lambda_{max.}$ 239 (ε 12 700 dm^3 mol^{-1} cm^{-1}) and 282sh nm (1 700).

4-(3-Ethyl-1-phenylureido)-5-methylpyrazol-3(2H)-one (**9d**). δ_H 0.98 (3 H, t, *J* 6.5 Hz, CH_2Me), 1.96 (3 H, s, 5-Me), 3.04 [2 H, m, CH_2Me, collapsed to quartet (*J* 6.5 Hz) by deuterium exchange], 5.93 (1 H, br, NH, deuterium exchangeable), and 7.18 (5 H, s, Ph); *m/z* 260 (M^+) and 189 (M − EtNCO, base peak); $\lambda_{max.}$ 243 nm (ε 10 600 dm^3 mol^{-1} cm^{-1}).

4-(3-Allyl-1-phenylureido)-5-methylpyrazol-3(2H)-one (**9e**). δ_H 1.98 (3 H, s, 5-Me), 3.63 (2 H, m, $CH_2CH{=}CH_2$), 4.88—6.17 (3 H, m, $CH_2CH{=}CH_2$), 6.95—7.24 (5 H, m, Ph), and 10.60 (1 H, br, NH, deuterium exchangeable); *m/z* 272 (M^+) and 189 (M − $CH_2{=}CHCH_2NCO$, base peak); $\lambda_{max.}$ 242 nm (ε 10 700 dm^3 mol^{-1} cm^{-1}).

4-(3-Butyl-1-phenylureido)-5-methylpyrazol-3(2H)-one (**9f**). δ_H 1.86 (3 H, t, *J* 5 Hz, CH_2Me), 109—1.47 (4 H, m, NCH_2-CH_2CH_2Me), 2.00 (3 H, s, 5-Me), 3.04 (2 H, m, NCH_2), 5.92 (1 H, br, NH, deuterium exchangeable), and 7.24 (5 H, s, Ph); *m/z* 288 (M^+) and 189 (M − BuNCO, base peak); $\lambda_{max.}$ 243 (ε 10 700 dm^3 mol^{-1} cm^{-1}).

4-Anilino-5-methylpyrazol-3(2H)-one (**10**).—(*a*) A mixture of the pyrazolone (**9a**) (0.49 g, 2 mmol) and sodium borohydride (0.09 g, 2.4 mmol) in dry pyridine (20 ml) was refluxed for 20 h. The solvent was removed under reduced pressure and dil. hydrochloric acid was added to the residue to give the crude product (0.26 g, 69%). Recrystallization from methanol gave the *4-anilinopyrazolone* (**10**), m.p. 225—227 °C; δ_H 1.98 (3 H, s, 5-Me), 6.38—7.14 (7 H, m, 2 × NH and Ph); the signal due to one NH-proton could not be observed; *m/z* 189 (M^+); $\nu_{max.}$ 3 400 cm^{-1} (NH); $\lambda_{max.}$ (EtOH) 247 (ε 16 600 dm^3 mol^{-1} cm^{-1}) and 291sh (2 500) (Found: C, 63.2; H, 5.8; N, 22.2. $C_{10}H_{11}N_3O$ requires C, 63.45; H, 5.85; N, 22.2%).

(*b*) A mixture of 5-anilino-1,3,6-trimethyluracil (**12**) (see below) (1.0 g, 4 mmol) and hydrazine hydrate (50 ml) was refluxed for 20 h. The solution was evaporated under reduced pressure and the residue was treated with water to give the crude product (**10**) (0.67 g, 87%). Recrystallization from ethanol gave the pyrazolone (**10**), which was identical with the product obtained above.

5-Anilino-1,3,6-trimethyluracil (**12**)—To a stirred solution of 5-amino-6-methyluracil (**11**)[8] (14 g, 64.5 mmol) in 20% aqueous NaOH (31 ml) was added dropwise dimethyl sulphate (17.9 g, 142 mmol). The precipitate was collected by filtration and dissolved in 10% aqueous NaOH. Insoluble matter was filtered off and recrystallized from ethanol to give the *uracil* (**12**) (6.8 g, 43%), m.p. 205—206 °C; δ_H 2.18 (3 H, s, 6-Me), 3.22 and 3.40 (each 3 H, each s, each NMe), and 6.40—7.20 (5 H, m, Ph); the signal due to one NH-proton could not be observed; *m/z* 245 (M^+); $\nu_{max.}$ 3 340 (NH) and 1 680 cm^{-1} (CO) (Found: C, 63.8; H, 6.15; N, 17.15. $C_{13}H_{15}N_3O_2$ requires C, 63.65; H, 6.15; N, 17.15%).

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Received 17*th September* 1984; *Paper* 4/1583