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Triazolo[4,5-*d*]pyrimidines. VI.[1] 3-Phenyl-3*H*-1,2,3-triazolo[4,5-*d*]-pyrimidine-7-carbonitrile and Related Compounds

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Nucleophilic reagents were found to react with 3-phenyl-3*H*-1,2,3-triazolo[4,5-*d*]-pyrimidine-7-carbonitrile (**1**) in two ways, depending on the nature of the reagent. One is substitution by attack of the reagent on the carbon at the 7-position, to which the cyano group is bonded. The other is addition to the cyano group by attack of the reagent at the carbon of the cyano group.

The substitution reaction occurs with amines, alkoxide ions, carbanions (active methylene compounds or ketones in the presence of sodium hydride), and the Grignard reagents, resulting in the formation of 4-alkylamino- (**2**), 4-alkoxy- (**3**), 4-substituted (**4**), and 4-alkyl-3-phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidines (**5**), respectively.

The addition reaction occurs in the reactions with 98% sulfuric acid and with hydroxylamine, resulting in the formation of amide (**6a**) and amidoxime (**7**), respectively.

The amide (**6a**) forms esters (**8**) with alcohols, in the presence of acid. The ethyl ester (**8b**) is hydrolyzed by ethanolic potassium hydroxide to give the acid (**9**). Moreover, **8b** reacts with amines, hydroxylamine, and hydrazines to form amides (**6b** and **6c**), hydroxamic acid (**10**), and hydrazides (**11a** and **11b**), respectively.

Keywords——3-phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidine-7-carbonitrile; nucleophilic substitution; 7-substituted 3-phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidines; addition reaction; carboxylic acid derivatives;

We have reported that treatment of 1-phenyl-1*H*-pyrazolo[3,4-*d*]pyrimidine-4-carbonitrile (I) with a nucleophilic reagent results in two kinds of reactions according to the nature of the reagent used.[3] For example, the reaction of I with amines gave 4-alkylamino-1-phenyl-1*H*-pyrazolo[3,4-*d*]pyrimidines (substitution reaction), and the reaction with hydroxyamine afforded 1-phenyl-1*H*-pyrazolo[3,4-*d*]pyrimidine-4-carboxamidoxime (addition reaction).[3]

In the present work, we reacted 3-phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidine-7-carbonitrile (**1**)[1] with several nucleophilic reagents, and found that both substitution and addition took place. The chemical properties of the resulting amide (**6a**) and ethyl ester (**8b**), obtained from the addition reaction, were examined.

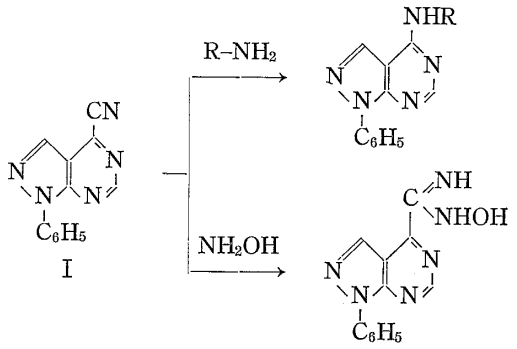

Chart 1

In benzene, **1** reacted with several amines as an *N*-nucleophile to give 7-alkylamino-3-phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidines (**2a** to **2f**)[1] in good yields (see Table I).

The cyano group of **1** was easily replaced by alkoxide ions to give 7-alkoxy-3-phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidines (**3a** to **3d**) in good yields (see Table I).

1) Part V: Higashino, T. Katori, H. Kawaraya, and E. Hayashi, *Chem. Pharm. Bull.*, "submitted".
2) Location: *a) 2–2–1 Oshika, Shizuoka-shi*; *b) 1143 Nanpeidai, Narita-shi.*
3) E. Hayashi, T. Higashino, and S. Suzuki, *Yakugaku Zasshi*, **98**, 981 (1978).

In N,N-dimethylformamide (DMF), the substitution reaction occurred with the carbanion formed from diethyl malonate in the presence of sodium hydride, resulting in the formation of diethyl 3-phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidine-7-malonate (**4a**).[1] Smilarly, the reactions with ethyl acetoacetate, 2,4-pentanedione, acetone, and acetophenone gave the corresponding 7-substituted 3-phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidines (**4b** to **4e**)[1] (see Table I). In the case of acetone, 4-hydroxy-4-methyl-1-(3-phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidin-7-yl)-2-pentanone (**4d'**)[1] was formed as a by-product.

When mixtures of **1** and Grignard reagents were refluxed in tetrahydrofuran (THF) and the resulting adducts were hydrolyzed, 7-alkyl-3-phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidines (**5a** to **5e**)[4] were formed, although the yields were poor (see Table I). In the case of benzylmagnesium chloride, 7,7'-(phenylmethylene)bis[3-phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidine] (**5d'**) and 5-amino-1-phenyl-1*H*-1,2,3-triazol-4-yl benzyl ketone (**5d''**) were formed as by-products. The identification of **2a** to **2f**, **3a** to **3d**, **4a** to **4e**, **4d'**, and **5a** to **5e** was achieved by mixed melting point tests with the corresponding authentic specimens prepared by specific routes.[1,4] The structures of **5d'** and **5d''** were suggested by their elemental analyses and confirmed by their infrared absorption (IR) and nuclear magnetic resonance (NMR) spectra, as described later.

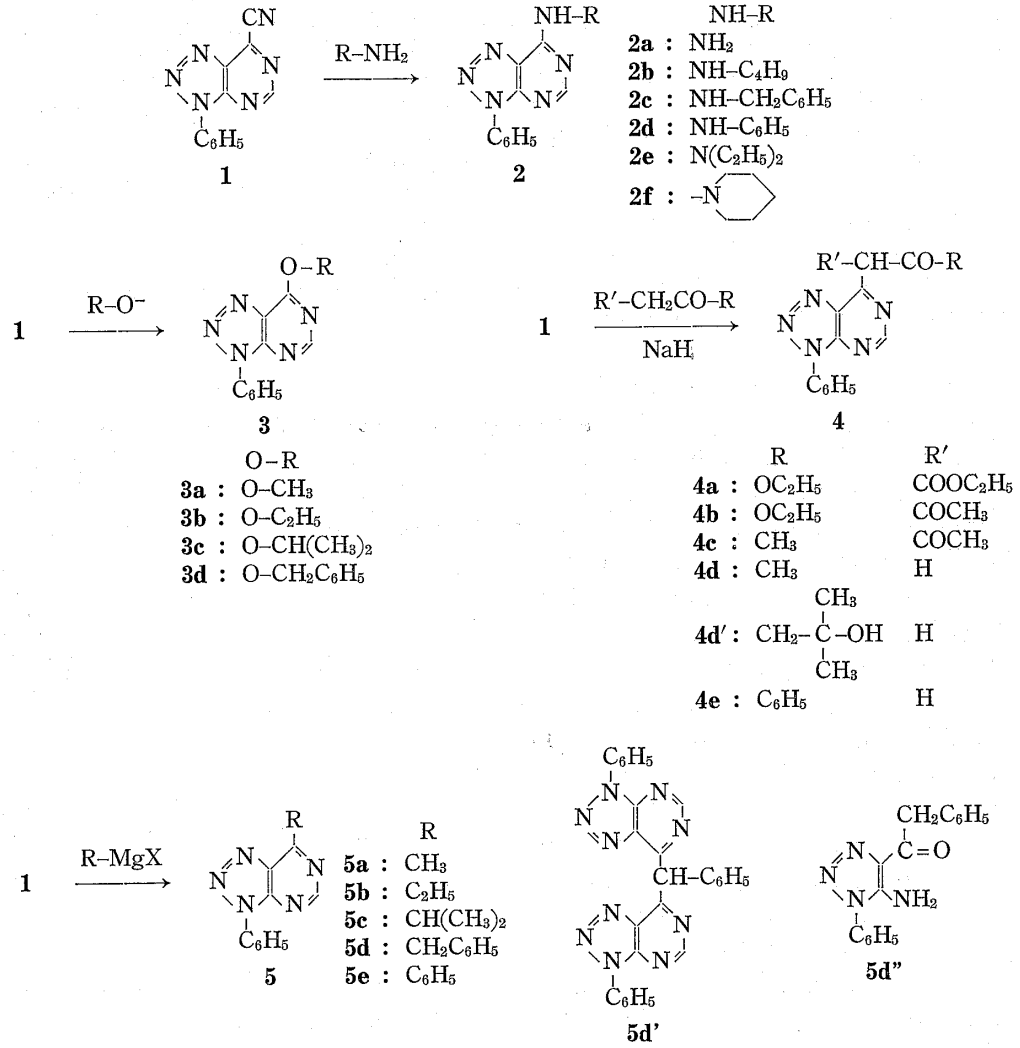

Chart 2

4) T. Higashino, T. Katori, S. Yoshida, and E. Hayashi, *Chem. Pharm. Bull.*, **27**, 3176 (1979).

Table I. The Nucleophilic Substitution of **1**

Nucleophilic reagent	Product			Reaction conditions		
	No.	Yield (%)	mp (°C)	Temperature	Time (min)	Solvent
NH_3	**2a**	81	294—295	r.t.	5	DMF
$C_4H_9NH_2$	**2b**	86	130—131	Reflux	30	Benzene
$C_6H_5CH_2NH_2$	**2c**	81	191—192	r.t.	30	Benzene
$C_6H_5NH_2$	**2d**	70	193—194	Reflux	90	Benzene
$(C_2H_5)_2NH$	**2e**	70	75— 76	r.t.	25	Benzene
	**2f**	88	95— 96	r.t.	10	Benzene
CH_3O^-	**3a**	89	136—137	Reflux	2	MeOH
$C_2H_5O^-$	**3b**	60	97— 98	r.t.	30	EtOH
$(CH_3)_2CHO^-$	**3c**	83	117—118	Reflux	60	iso-PrOH
$C_6H_5CH_2O^-$	**3d**	76	124—125	Reflux	10	BzOH
$CH_2(COOC_2H_5)_2$	**4a**	67	160—161	r.t.	15	DMF
$CH_2{<}^{COCH_3}_{COOC_2H_5}$	**4b**	29	153—155	r.t.	30	DMF
$CH_2(COCH_3)_2$	**4c**	38	198—200	r.t.	30	DMF
CH_3COCH_3	**4d**	33	222—226	r.t.	30	DMF
	4d′	7	187—189			
$CH_3COC_6H_5$	**4e**	75	218—219	r.t.	10	DMF
CH_3MgI	**5a**	14	116—117	Reflux	120	THF
C_2H_5MgBr	**5b**	13	44— 45	Reflux	120	THF
$(CH_3)_2CHMgBr$	**5c**	5	72— 74	Reflux	120	THF
$C_6H_5CH_2MgBr$	**5d**	3	123—125	Reflux	120	THF
	5d′	15	284—285			
	5d″	3	140—141			
C_6H_5MgBr	**5e**	3	127—128	Reflux	120	THF

r.t.=room temperature, DMF=N,N-dimethylformamide, THF=tetrahydrofuran.

When a solution of **1** in 98% sulfuric acid was heated at 90° for 5 min, sulfuric acid added across the C–N triple bond of the cyano group to form the adduct (**6′**) which readily underwent hydrolysis to the amide (**6a**) in excellent yield. Similarly, **1** reacted with hydroxylamine to give amidoxime (**7**) in good yield. The structures of **6a** and **7** were suggested by their elemental analyses and confirmed by their IR and NMR spectra, as described later.

When a solution of the amide (**6a**) in an alcohol in the presence of 98% sulfuric acid was refluxed for 3 hr, esterification took place to provide the ester (**8a** or **8b**) in moderate yield.

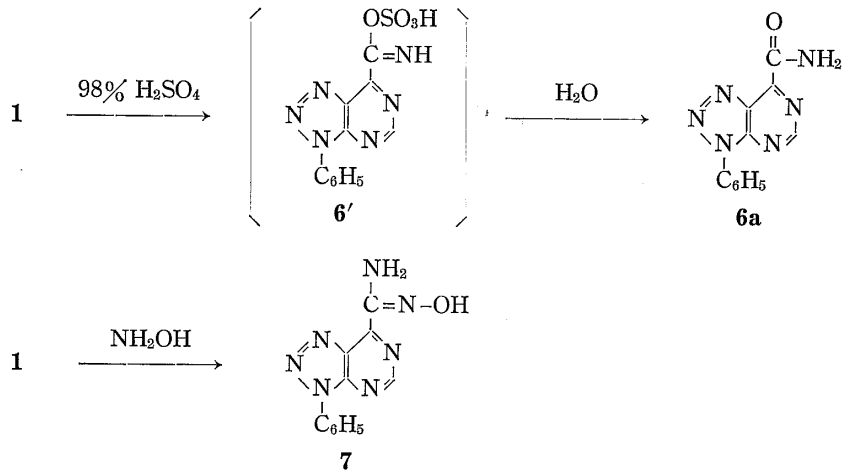

Chart 3

The structures of **8a** and **8b** were suggested by their elemental analyses and confirmed by their IR and NMR spectra, as described later.

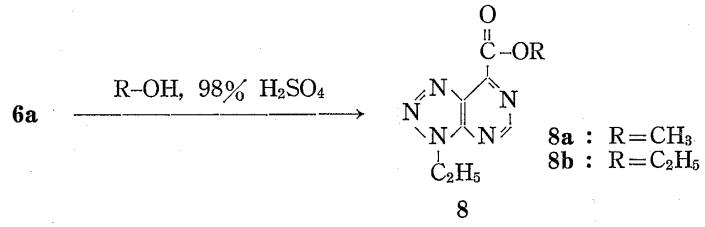

Chart 4

The ethyl ester (**8b**) was hydrolyzed in ethanolic potassium hydroxide solution to afford the carboxylic acid (**9**) in excellent yield. Moreover, **8b** was converted to the N-hexylamide (**6b**) by reaction with hexylamine. In DMF the reaction of **8b** with aniline in the presence of sodium hydride gave the N-phenylamide (**6c**). Hydroxylamine, hydrazine, and phenylhydrazine reacted with **8b** to give the hydroxamic acid (**10**), hydrazide (**11a**), and phenylhydrazide (**11b**), respectively. The structures of the acid (**9**), amides (**6b** and **6c**), hydroxamic acid (**10**), and hydrazides (**11a** and **11b**) were suggested by their elemetal analyses and confirmed by their IR and NMR spectra, as described later.

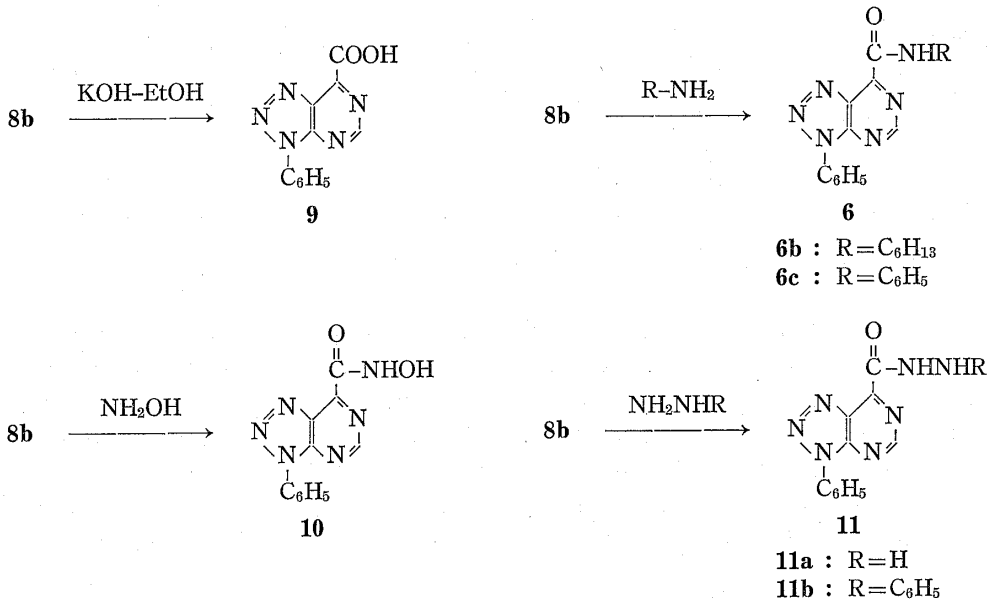

Chart 5

On the basis of these results, it appears that the application of a nucleophilic reagent to **1** results in two kinds of reactions, depending on the nature of the reagent used. One is substitution by attack of the reagent on the carbon at the 7-position, to which the cyano group is bonded. The other is addition to the cyano group by attack of the reagent at the carbon of the cyano group.

Experimental[5]

IR spectra were recorded on a Jasco IRA-1 grating infrared spectrometer. NMR spectra were measured at 60 Mc and 23° on a Hitachi R-24 high resolution NMR spectrometer using tetramethylsilane as an internal standard. Mass (MS) spectra were recorded on a Hitachi RMS-4 mass spectrometer. Exact mass measure-

5) Melting points are uncorrected.

ments (EMM) were carried out on a JEOL JMS-01SG-2 mass spectrometer combined with a JEC-6 spectrum computer. Samples were vaporized in a direct inlet system.

7-Amino-3-phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidine (2a)——A solution of 200 mg (0.9 mmol) of **1** and 5.0 ml of 28% aqueous NH_3 in 5.0 ml of DMF was allowed to stand for 5 min, then the reaction mixture was poured into 50.0 ml of H_2O. The separated crystas were collected, washed with H_2O, and recrystallized from MeOH to give **2a**, mp 294—295°, in 81% yield (158 mg).

7-Butylamino- (2b), 7-Benzylamino- (2c), 7-Anilino- (2d), 7-(N,N-Diethylamino)- (2e), and 7-Piperidino-3-phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidines (2f)——A solution of 200 mg of **1** and 2.0 mmol of amine (butylanine, benzylamine, aniline, N,N-diethylamine, or piperidine) was stirred under the conditions described in Table I, then the reaction mixture was poured into 50.0 ml of H_2O. The separated crystals were collected, washed with H_2O, and recrystallized from MeOH or benzene to give 7-alkylamino-3-phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidines (**2b** to **2f**). The yields are listed in Table I.

7-Methoxy- (3a), 7-Ethoxy- (3b), 7-Isopropoxy- (3c), and 7-Benzyloxy-3-phenyl-3*H*-1,2,3-triazolo[4,5-*d*]-pyrimidines (3d)——Compound **1** (200 mg, 0.9 mmol) was added to a solution of sodium alkoxide, prepared from 21 mg of Na and 12.0 ml of alcohol (MeOH, EtOH, iso-PrOH, or BzOH), and the mixture was stirred under the conditions described in Table I. Alcohol was removed under reduced pressure, and the residue was washed with H_2O and recrystallized from MeOH to give 7-alkoxy-3-phenyl-3*H*-1,2,3-triazolo[4,5-*d*]-pyrimidine (**3a** to **3d**). The yields are listed in Table I.

Diethyl 3-Phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidine-7-malonate (4a)——A solution of 200 mg (0.9 mmol) of **1** in 3.0 ml of DMF was added to a solution of 144 mg (0.9 mmol) of diethyl malonate and 43 mg of 50% NaH (in oil) in 3.0 ml of DMF, and the mixture was stirred for 15 min. The reaction mixture was poured into 15.0 ml of the H_2O and neutralized with dilute AcOH. The separated crystals were collected, washed with H_2O, and recrystallized from MeOH to give **4a** in 67% yield (214 mg).

Ethyl *α*-Acetyl-3-phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidine-7-acetate (4b)——A solution of 200 mg (0.9 mmol) of **1** in 3.0 ml of DMF was added to a solution of 117 mg (0.9 mmol) of ethyl acetoacetate and 43 mg of 50% NaH (in oil) in 3.0 ml of DMF, and the mixture was stirred for 30 min. Compound **4b** was isolated as described in the preparation of **4a**. The yield was 86 mg (29%).

3-(3-Phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidin-7-yl)-2,4-pentanedione (4c)——A solution of 200 mg (0.9 mmol) of **1** in 3.0 ml of DMF was added to a solution of 90 mg (0.9 mmol) of 2,4-pentanedione and 43 mg of 50% NaH (in oil) in 3.0 ml of DMF, and the mixture was stirred for 30 min. Compound **4c** was isolated as described in the preparation of **4a**. The yield was 102 mg (38%).

1-(3-Phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidin-7-yl)-2-propanone (4d)——A solution of 200 mg (0.9 mmol) of **1** in 2.0 ml of DMF was added to a solution of 6.0 ml of acetone and 90 mg of 50% NaH (in oil), and the mixture was stirred for 30 min. The reaction mixture was poured into 30.0 ml of H_2O and neutralized with dilute AcOH. The separated crystalline solid was extracted with benzene and dried over Na_2SO_4. The residue, obtained by the removal of benzene from the extract, was chromatographed on a column of silica gel, eluting with benzene and acetone. Elution with benzene gave **4d** in 33% yield (76 mg), and elution with acetone gave 4-hydroxy-4-methyl-1-(3-phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidin-7-yl)-2-pentanone (**4d'**) in 7% yield (20 mg).

2-(3-Phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidine-7-yl)acetophenone (4e)——A solution of 600 mg (2.7 mmol) of **1** in 15.0 ml of DMF was added to a solution of 200 mg of acetophenone and 400 mg of 50% NaH (in oil) in 8.0 ml of DMF, and the mixture was stirred for 10 min. The reaction mixture was poured into 60.0 ml of H_2O and extracted with $CHCl_3$. The $CHCl_3$ extract was dried over Na_2SO_4, and $CHCl_3$ was removed under reduced pressure. The residue was recrystallized from benzene–petr. ether to give **4e** in 75% yield (640 mg).

7-Methyl- (5a), 7-Ethyl- (5b), 7-Isopropyl- (5c), and 7-Phenyl-3-phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidines (5e)——The Grignard reagents were prepared by the usual method from 10.0 mmol of alkyl halides (CH_3I, C_2H_5Br, $(CH_3)_2CHBr$, and C_6H_5Br) and 270 mg of Mg in 6.0 ml of ether. This solution was gradually added to a stirred solution of 1110 mg of **1** in 10.0 ml of THF, and the mixture was refluxed for 2 hr. The solvent was removed by decantation, and a solution of 1000 mg of NH_4Cl and 1.0 ml of 28% aqueous NH_3 in 5.0 ml of H_2O was added to the residue (adduct). The reaction mixture was extracted with $CHCl_3$ and dried over Na_2SO_4. The $CHCl_3$ extract was chromatographed on a column of alumina using $CHCl_3$ as an eluent. The first fraction gave 7-alkyl-3-phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidines (**5a**, **5b**, **5c**, and **5e**)[4] which were purified by recrystallization from petr. ether. The yields are listed in Table I.

7-Benzyl-3-phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidine (5d)——Benzylmagnesium chloride was prepared by the usual method from 10.0 mmol of benzyl chloride and 270 mg of Mg in 6.0 ml of ether. This solution was gradually added to a stirred solution of 1110 mg of **1** in 10.0 ml of THF, and the mixture was refluxed for 2 hr. The solvent was removed by decantation, and the residue (adduct) was hydrolyzed by adding a solution of 1000 mg of NH_4Cl and 1.0 ml of 28% aqueous NH_3 in 5.0 ml of H_2O. The reaction mixture was extracted with $CHCl_3$ and dried over Na_2SO_4. The residue, obtained by the removal of $CHCl_3$, was dissolved in benzene. The benzene–insoluble crystals were recrystallized from $CHCl_3$ to give 7,7'-(phenylmethylene)-bis[3-phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidine] (**5d'**), mp 284—285°, as yellow needles in 15% yield (350 mg). *Anal.* Calcd for $C_{27}H_{18}N_{10}$: C, 67.20; H, 3.77; N, 29.30. Found: C, 66.51; H, 3.74; N, 28.81. MS *m/e*: 482

(M^+). NMR (in DMSO-d_6) ppm: 7.5—8.4 (15H, multiplet, $(C_6H_5)_3$), 8.44 (1H, singlet, $CH(Ar)_3$), 8.97 (2H, singlet, $(5\text{-}H)_2$).

The benzene–soluble crystals were chromatographed on a column of alumina using benzene as an eluent. The first fraction gave **5d**[4] in 3% yield (45 mg), and the second gave 5-amino-1-phenyl-1*H*-1,2,3-triazol-4-yl benzyl ketone (**5d′**), mp 140—141° as colorless needles from benznee–petr. ether, in 3% yield (35 ml). *Anal.* Calcd for $C_{16}H_{14}N_4O$: C, 69.04; H, 5.08; N, 20.13. Found: C, 68.73; H, 5.04; N, 20.10. IR ν_{max}^{KBr} cm^{-1}: 3290, 3420 (NH_2), 1660 (C=O). NMR (in $CDCl_3$) ppm: 4.32 (2H, singlet, CH_2–Ar), 5.7 (2H, broad singlet exchangeable with D_2O, NH_2), 7.0—7.6 (10H, multiplet, $(C_6H_5)_2$).

3-Phenyl-3H-1,2,3-triazolo[4,5-*d*]pyrimidine-7-carboxamide (6a)——A mixture of 3000 mg of **1** and 24.0 ml of 98% H_2SO_4 was heated at 90° for 5 min, and the reaction mixture was poured onto 70 g of ice. The separated crystals were collected, washed with H_2O, and recrystallized from $CHCl_3$ to give **6a**, mp 198—201° as colorless needles in 92% yield (2790 mg). *Anal.* Calcd for $C_{11}H_8N_6O$: C, 55.00; H, 3.36; N, 34.99. Found: C, 54.45; H, 3.37; N, 34.55. MS *m/e*: 240 (M^+). IR ν_{max}^{KBr} cm^{-1}: 3300, 3200 (NH_2), 1690 (C=O). NMR (in $CDCl_3$–DMSO-d_6) ppm: 7.4—8.4 (5H, multiplet, C_6H_5), 7.9 (2H, broad singlet exchangeable with D_2O, NH_2), 9.35 (1H, singlet, 5–H).

3-Phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidine-7-carboxamidoxime (7)——Potassium carbonate (274mg) was added to a mixture of 400 mg of **1** and 138 mg of $NH_2OH \cdot HCl$ in 10.0 ml of benzene and 10.0 ml of MeOH, and the mixture was stirred for 3 hr. The separated crystals were collected, washed with H_2O, dried, and recrystallized from MeOH to give **7**, mp 285—286°, as yellow needles in 96% yield (440 mg). EMM *m/e* Calcd for $C_{11}H_9N_7O$: 255.0868 (M^+). Found: 255.0837. IR ν_{max}^{KBr} cm^{-1}: 3450, 3350, 3300 (NH_2 or OH). NMR (in $CDCl_3$–DMSO-d_6) ppm: 6.1 (2H, broad singlet exchangeable with D_2O, NH_2), 7.4—8.4 (5H, multiplet, C_6H_5), 9.23 (1H, singlet, 5–H), 11.2 (1H, broad singlet, exchangeable with D_2O, OH).

Methyl 3-Phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidine-7-carboxylate (8a)——A mixture of 350 mg of **6a** and 0.2 ml of 98% H_2SO_4 in 10.0 ml of MeOH was refluxed for 3 hr. MeOH was removed under reduced pressure, and the residue was extracted with $CHCl_3$. The $CHCl_3$ extract was washed with aqueous $NaHCO_3$ and H_2O, then dried over Na_2SO_4. The extract was chromatographed on a column of silica gel using $CHCl_3$ as an eluent. The first fraction gave **8a**, mp 165—167°, as slightly yellow needles from MeOH in 64% yield (237 mg). *Anal.* Calcd for $C_{12}H_9N_5O_2$: C, 56.47; H, 3.55; N, 27.44. Found: C, 56.40; H, 3.59; N, 27.43. IR ν_{max}^{KBr} cm^{-1}: 1715 (C=O). NMR (in $CDCl_3$) ppm: 4.20 (3H, singlet, OCH_3), 7.4—8.4 (5H, multiplet, C_6H_5), 9.40 (1H, singlet, 5–H).

Ethyl 3-Phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidine-7-carboxylate (8b)——A mixture of 3000 mg of **6a** and 5.0 ml of 98% H_2SO_4 in 80.0 ml of EtOH was refluxed for 3 hr. Compound **8b**, mp 104—105°, was isolated as colorless needles in 48% yield (1600 mg), using the method described for the preparation of **8a**. *Anal.* Calcd for $C_{13}H_{11}N_5O_2$: C, 57.98; H, 4.12; N, 26.01. Found: C, 57.80; H, 4.08; N, 26.13. IR ν_{max}^{KBr} cm^{-1}: 1715 (C=O). NMR (in $CDCl_3$) ppm: 1.55 (3H, triplet, $OCH_2C\underline{H}_3$, $J=7$ Hz), 4.68 (2H, quartet, $OC\underline{H}_2CH_3$), 7.4—8.4 (5H, multiplet, C_6H_5), 9.35 (1H, singlet, 5–H).

3-Phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidine-7-carboxylic Acid (9)——KOH (300 mg) was added to a solution of 150 mg of **8b** in 25.0 ml of EtOH, and the mixture was stirred for 30 min. EtOH was removed under reduced pressure, and the residue was acidified with 2N HCl. The separated crystals were collected and washed with H_2O to give **9**, mp 127—128° (dec.), in 98% yield (132 mg). *Anal.* Calcd for $C_{11}H_7N_5O_2$: C, 54.77; H, 2.93; N, 29.04. Found: C, 54.35; H, 2.99; N, 29.01. IR ν_{max}^{KBr} cm^{-1}: 1705 (C=O). NMR (in $CDCl_3$–DMSO-d_6) ppm: 7.4—8.4 (5H, multiplet, C_6H_5), 9.42 (1H, singlet, 5–H), 11.4 (1H, broad singlet exchangeable with D_2O, COOH).

N-Hexyl-3-phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidine-7-carboxamide (6b)——A mixture of 300 mg of **8b** and 1000 mg of hexylamine was heated at 60° for 15 min. The reaction mixture was poured into 10.0 ml of H_2O and acidified with 2N HCl. The separated crystals were collected, washed with H_2O and recrystallized from benzene–petr. ether to give **6b**, mp 128—129°, as slightly yellow needles in 81% yield (293 mg). *Anal.* Calcd for $C_{17}H_{20}N_6O$: C, 62.94; H, 6.21; N, 25.91. Found: C, 62.78; H, 6.24; N, 26.07. IR ν_{max}^{KBr} cm^{-1}: 3310 (NH), 1665 (C=O). NMR (in $CDCl_3$) ppm: 0.9—2.0 (11H, multiplet, $NCH_2C_5\underline{H}_{11}$), 3.57 (2H, quartet, $NHC\underline{H}_2C_5H_{11}$), 8.1 (1H, broad singlet exchangeable with D_2O, NH), 7.4—8.5 (5H, multiplet, C_6H_5), 9.15 (1H, singlet, 5–H).

3,N-Diphenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidine-7-carboxamide (6c)——NaH (50 mg, 60% in oil) was added to a solution of 300 mg of **8b** and 1000 mg of aniline in 20.0 ml of DMF, and the mixture was stirred for 24 hr. DMF was removed under reduced pressure, and the residue was acidified with 2N HCl. The separated crystals were collected, washed with H_2O and recrystallized from MeOH to give **6c**, mp 191—192°, as slightly yellow needles in 64% yield (224 mg). *Anal.* Calcd for $C_{17}H_{12}N_6O$: C, 64.55; H, 3.82; N, 26.57. Found: C, 64.29; H, 3.88; N, 26.52. IR ν_{max}^{KBr} cm^{-1}: 3350 (NH), 1690 (C=O). NMR (in $CDCl_3$–DMSO-d_6) ppm: 7.0—8.4 (10H, multiplet, $(C_6H_5)_2$), 7.5 (1H, broad singlet exchangeable with D_2O, NH), 9.43 (1H, singlet, 5–H).

3-Phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidine-7-carbohydroxamic Acid (10)——NaH (55 mg, 60% in oil) was added to a stirred solution of 100 mg of $NH_2OH \cdot HCl$ in 10.0 ml of EtOH. When evolution of H_2 gas stopped, a solution of 300 mg of **8b** in 20.0 ml of EtOH was added, and the mixture was stirred for 2 hr. EtOH was removed under reduced pressure, and the residue was acidified with 2N HCl. The separated cry-

stals were collected and recrystallized from EtOH to give **10**, mp 198—200°, as colorless needles in 23% yield (65 mg). *Anal.* Calcd for $C_{11}H_8N_6O_2$: C, 51.56; H, 3.15; N, 32.80. Found: C, 51.49; H, 3.21; N, 32.68. IR ν_{max}^{KBr} cm^{-1}: 3250, 3200 (NH or OH), 1685 (C=O). NMR (in $CDCl_3$–DMSO-d_6) ppm: 7.3—8.4 (5H, multiplet, C_6H_5), 9.11 (1H, broad singlet exchangeable with D_2O, NH), 9.32 (1H, singlet, 5–H), 11.8 (1H, broad singlet exchangeable with D_2O, OH).

3-Phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidine-7-carbohydrazide (11a)——A solution of 300 mg of **8b** and 500 mg of 80% $NH_2NH_2 \cdot H_2O$ in 10.0 ml of EtOH was heated at 60° for 15 min. After cooling, the separated crystals were collected and recrystallized from MeOH to give **11a**, mp 208—209°, as slightly yellow scales in 60% yield (172 mg). *Anal.* Calcd for $C_{11}H_9N_7O$: C, 51.76; H, 3.55; N, 38.42. Found: C, 51.52; H, 3.56; N, 38.11. MS *m/e*: 255 (M^+). IR ν_{max}^{KBr} cm^{-1}: 3300, 3230, 3150 (NH or NH_2), 1685 (C=O). NMR (in $CDCl_3$–DMSO-d_6) ppm: 5.0 (2H, broad singlet exchangeable with D_2O NH_2), 7.6 (1H, broad singlet exchangealbe with D_2O, NH), 7.4—8.4 (5H, multiplet, C_6H_5), 9.37 (1H, singlet, 5–H).

2-Phenyl-1-(3-phenyl-3*H*-1,2,3-triazolo[4,5-*d*]pyrimidine-7-carbonyl)hydrazine (11b)——A mixture of 300 mg of **8b** and 1000 mg of phenylhydrazine was heated at 90° for 1 hr. The reaction mixture was acidified with 2N HCl and extracted with $CHCl_3$. The $CHCl_3$ extract was washed with aqueous $NaHCO_3$ and H_2O, then dried over Na_2SO_4. $CHCl_3$ was removed under reduced pressure, and the residue was recrystallized from EtOH to give **11b**, mp 202—203° (dec.), as brown scales in 35% yield (129 mg). *Anal.* Calcd for $C_{17}H_{13}N_7O$: C, 61.62; H, 3.95; N, 29.59. Found: C, 61.11; H, 3.98; N, 29.42. MS *m/e*: 331 (M^+). IR ν_{max}^{KBr} cm^{-1}: 3370, 3310 (NH), 1690 (C=O). NMR (in $CDCl_3$–DMSO-d_6) ppm: 6.5—7.4 (5H, multiplet, C_6H_5), 7.0 (1H, broad singlet exchangeable with D_2O, NH), 7.4—8.4 (5H, multiplet, C_6H_5), 8.1 (1H, broad singlet exchangeable with D_2O, NH), 9.38 (1H, singlet, 5–H).

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