Reactions of 3-hydroxytetrahydropyrimidin-4-ones with electrophilic reagents

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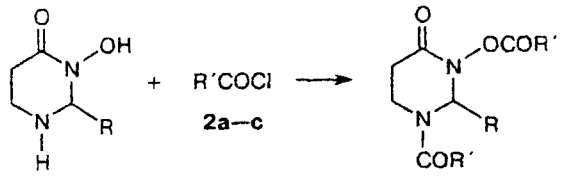
The reactions of nonsubstituted or 2-aryl-substituted 3-hydroxytetrahydropyrimidin-4-ones (HTHP) with carboxylic acid chlorides, tosyl chloride, or aryl isocyanates afford mainly *N,O*-diacylated, *N,O*-ditosylated, or *N,O*-diarylcarbamoylated HTHP, respectively. *N,O*-Diacylated HTHP are also formed in the reactions of acid chlorides with Schiff's bases based on β-aminopropionohydroxamic acid. *N*-Acylated HTHP can be obtained by treating *N,O*-diacylated HTHP with ammonia. The reactions of 2,2-dialkyl(alkylene)-substituted HTHP with acid chlorides or phenyl isocyanate give *N,O*-diacylated or *N,O*-diphenylcarbamoylated β-aminopropionohydroxamic acid, respectively.

Key words: 3-hydroxytetrahydropyrimidin-4-ones, *N,O*-diacylated 3-hydroxytetrahydropyrimidin-4-ones, *N*-acylated 3-hydroxytetrahydropyrimidin-4-ones, β-aminopropionohydroxamic acid, acylation, tosylation, arylcarbamoylation, Schiff's bases.

Previously,[1] in studies on the reactions of carboxylic acid chlorides with 3-hydroxy-1,2-dihydroquinazolin-4-ones (HDHQ), we have demonstrated that the structures of the products are determined by the number and the type of substituents at position 2 of the HDHQ as well as by the nature of the acid chlorides. The benzene nucleus in HDHQ hinders the electrophilic attack on the N(1) atom and in some instances favors the formation of 3-hydroxyquinazolin-4-ones. It was reasonable to assume that the regularities of the reactions with electrophilic reagents could be substantially changed on going from HDHQ to 3-hydroxytetrahydropyrimidin-4-ones (HTHP; HDHQ are benzo-analogs of HTHP), all the more so since HTHP, unlike HDHQ, can exist in solutions in a tautomeric equilibrium with the linear forms, *viz.*, with Schiff's bases of β-aminopropionohydroxamic acid,[2] which as such can react with electrophilic reagents. Taking into account the aforesaid, we studied the major regularities of the reactions of 2-nonsubstituted and 2-substituted HTHP (**1a—e**) with electrophilic reagents, *viz.*, with AcCl, BzCl, TsCl, and ArNCO as well as with some of their functional derivatives. In DMSO solutions, compounds **1b** and **1c** exist in the linear form, which amounts to 40 and 15%, respectively. All the other compounds under study exist virtually completely in the cyclic form. In $CDCl_3$, all HTHP under study exist in the cyclic form.[2]

The nature of the reaction products of HTHP with electrophilic reagents, as in the case of the reactions with HDHQ, is substantially affected by the substituent at position 2 of the heterocycle. 1-Acyl-3-acyloxytetrahydropyrimidin-4-ones **3** are generally obtained as the major reaction products of nonsubstituted and 2-aryl-substituted HTHP with carboxylic acid chlorides (Scheme 1). Their yields are ~50—75 % (Table 1).

Scheme 1



1a—c **3a—f**

a: R = H
b: R = Ph
c: R = 4-$O_2NC_6H_4$

a: R' = Me
b: R' = Ph
c: R' = 4-$O_2NC_6H_4$

a: R = H; R' = Ph
b: R = H; R' = 4-$O_2NC_6H_4$
c: R = Ph; R' = Me
d: R = R' = Ph
e: R = 4-$O_2NC_6H_4$; R' = Me
f: R = 4-$O_2NC_6H_4$; R' = Ph

This result was quite expected in the reactions of HTHP with a twofold excess of an electrophilic reagent. However, the situation remained unchanged when the reagents were taken in an equimolar ratio. In this case, bis-*N,O*-acylated derivatives were also isolated as the major products but their yields decreased to ~30% with respect to the initial HTHP.

In the series of carboxylic acid chlorides under study, the unexpected result was observed with chloroacetyl chloride (**2d**). In these cases, we managed to isolate only monoacylation products **4a,b** in low yields (Scheme 2).

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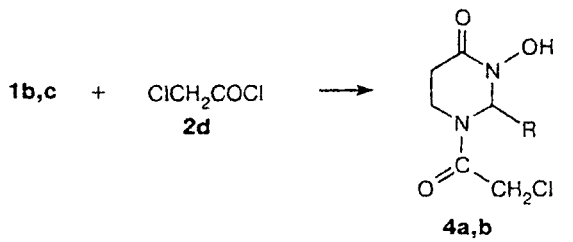
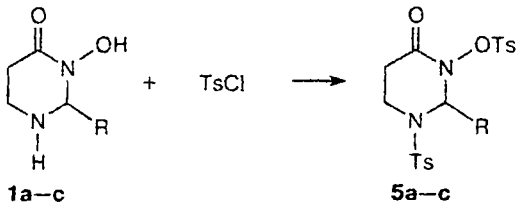
Scheme 2



a: R = Ph
b: R = 4-$O_2NC_6H_4$

Scheme 3



a: R = H
b: R = Ph
c: R = 4-$O_2NC_6H_4$

By analogy with the reaction of **2d** with HDHQ,[1] one would expect that *N,O*-diacylation products will eliminate acid to form unstable compounds, *viz.*, 2-R-1-chloroacetyl-1*H*-5,6-dihydropyrimidin-4-ones. The reactions of compounds **1a—c** with sulfonyl chlorides should proceed analogously. However, it appeared that the reactions of HTHP with TsCl, like the reactions of HTHP with carboxylic acid chlorides **2a—c**, gave *N,O*-ditosylation products **5a—c** as the major products (Scheme 3), though in low yields.

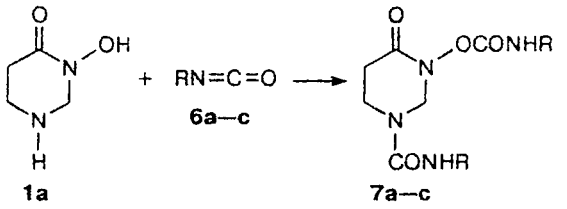
The rather general character of the reactions of nonsubstituted and 2-aryl-substituted HTHP with electrophilic reagents, which afford products of the attack on the hydroxyl and secondary amino groups, is also confirmed by the results of the reactions of compound **1a** with aryl isocyanates **6a—c** to form *N,O*-dicarbamoylated HTHP (**7a—c**) (Scheme 4).

Direct acylation of HTHP cannot be used for preparing *N*-acyl-substituted HTHP. In this connection, we developed a simple method for the synthesis of the latter com-

Table 1. The yields, the melting points, and the data of elemental analysis of substituted HTHP **3**, **5**, and **7**

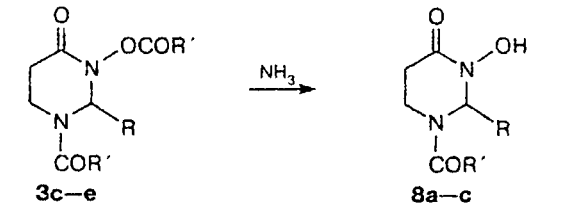
Compound	R	R′	Yield (%)	M.p. /°C	Found / Calculated (%) C	H	Molecular formula
3a	H	Bz	64	140—142	66.56 66.64	5.25 4.98	$C_{18}H_{16}N_2O_4$
3b	H	4-$NO_2C_6H_4CO$	56	177—178	52.16 52.18	3.54 3.41	$C_{18}H_{14}N_4O_8$
3c	Ph	Ac	52	161—162	60.86 60.86	5.74 5.84	$C_{14}H_{16}N_2O_4$
3d	Ph	Bz	61	146—148	71.30 71.99	5.03 5.03	$C_{24}H_{20}N_2O_4$
3e	4-$NO_2C_6H_4$	Ac	68	160—162	52.26 52.34	4.79 4.71	$C_{14}H_{15}N_3O_6$
3f	4-$NO_2C_6H_4$	Bz	76	151—152	64.48 64.72	4.49 4.30	$C_{24}H_{19}N_3O_6$
3g	3-$MeOC_6H_4$	Ac	73	169—171	58.13 58.82	5.54 5.92	$C_{15}H_{18}N_2O_5$
3h	3-$MeOC_6H_4$	Bz	51	178—179	69.15 69.76	5.13 5.15	$C_{25}H_{22}N_2O_5$
5a	H	Ts	54	163—165	51.13 50.93	4.78 4.75	$C_{18}H_{20}N_2O_6S_2$
5b	Ph	Ts	28	161—162	57.00 57.59	4.17 4.83	$C_{24}H_{24}N_2O_6S_2$
5c	4-$NO_2C_6H_4$	Ts	33	143—145	51.72 52.84	4.53 4.25	$C_{24}H_{23}N_3O_8S_2$
7a	H	PhNHCO	52	154—155	59.98 61.01	5.56 5.12	$C_{18}H_{18}N_4O_4$
7b	H	4-ClC_6H_4NHCO	42	192—194	50.13 51.08	5.56 5.81	$C_{18}H_{16}N_4O_4Cl_2$
7c	H	4-$NO_2C_6H_4NHCO$	53	202—204	47.66 48.65	3.90 3.63	$C_{18}H_{16}N_6O_8$

Scheme 4



a: R = Ph
b: R = 4-ClC_6H_4
c: R = 4-$O_2NC_6H_4$*

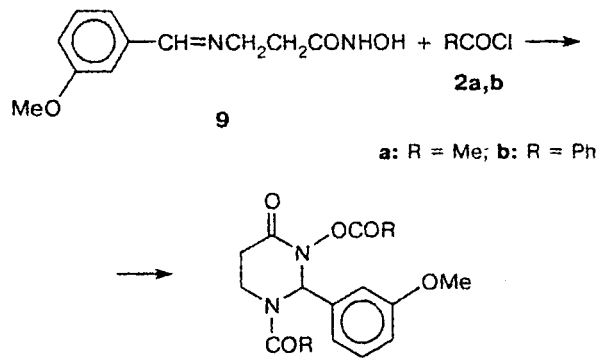
Scheme 5



c: R = Ph; R′ = Me
d: R = R′ = Ph
e: R = 4-$O_2NC_6H_4$; R′ = Me

a: R = Ph; R′ = Me
b: R = R′ = Ph
c: R = 4-$O_2NC_6H_4$; R′ = Me

Scheme 6



g: R = Me; **h:** R = Ph

pounds. This method involves treatment of *N,O*-diacylated derivatives of HTHP with ammonia (Scheme 5).

As mentioned above, some HTHP under study can exist in tautomeric equilibrium with their linear forms (Schiff's bases).[2] It was reasonable to suggest that acylated derivatives of HTHP **3**—**5** and **7** were formed predominantly as a result of acylation of the cyclic forms.

* Compound **6c** was prepared *in situ* by thermolysis of 4-$O_2NC_6H_4CON_3$.

However, the formation of compounds **3**—**5** and **7** from Schiff's bases, at least partially, could not be ruled out. To test the validity of this assumption, 3-(3-methoxybenzylideneamino)propionohydroxamic acid (**9**), which undoubtedly exists in the acyclic form, was treated with 2 equiv. of AcCl or BzCl. In these cases, the corresponding *N,O*-diacylated HTHP **3g** and **3h** were obtained in satisfactory yields (Scheme 6).

Therefore, the reactions of electrophilic reagents with nonsubstituted HTHP, 2-aryl-substituted HTHP, or Schiff's bases based on β-aminopropionohydroxamic acid gave *N,O*-disubstituted HTHP as the major products.

The reactions of 2,2-dimethyl-substituted HTHP under study and of 1-hydroxy-1,5-diazaspiroundecan-2-one (**1e**) gave different results. Their reactions with carboxylic acid chlorides and isocyanates (followed by recrystallization of the resulting compounds from water or ethanol, as in the above-described examples) afforded *N,O*-diacylated or *N,O*-dicarbamoylated β-aminopropionohydroxamic acid (**10** or **11**), respectively, as the major products regardless of the ratio of the reagents used. Apparently, these products were formed upon hydrolysis of *N,O*-diacylation (dicarbamoylation) products **1** that initially formed (Scheme 7).

Compounds **10** and **11** can be prepared also by direct acylation of β-aminopropionohydroxamic acid (**12**) (Scheme 8).

Generally, the structures of the resulting compounds were inferred based on the data of elemental analysis and ^1H NMR spectroscopy and in some cases based on the data of ^{13}C NMR spectroscopy and the qualitative test for the hydroxamic group with $FeCl_3$. The signals for the protons at position 2 of HTHP (for acylated

Scheme 7

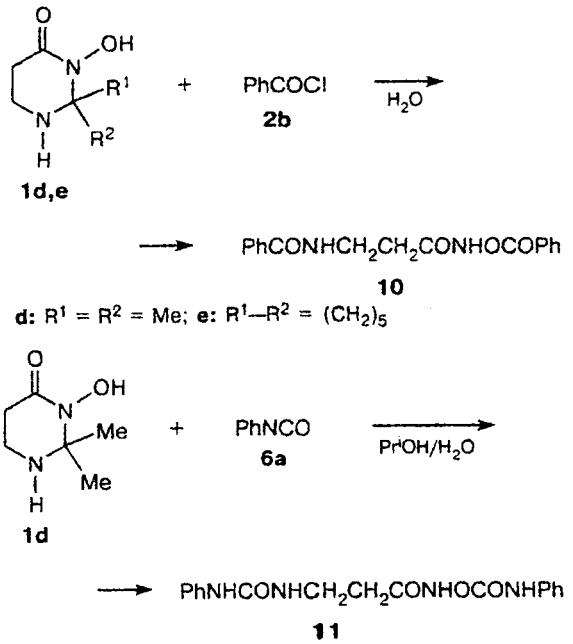
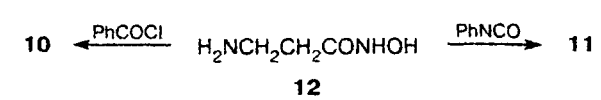


Table 2. ^{1}H NMR spectra of substituted HTHP **3**, **5**, and **7**

Compound	Solvent	δ (*J*/Hz)
3a	DMSO-d_6	2.70 (t, 2 H, $COCH_2$, J = 8); 3.75 (2 H, NCH_2); 5.28 (s, 2 H, NCH_2N); 7.48—7.60 (m, 7 H, H arom.); 7.75 (t, 1 H, H arom., J = 10); 8.00 (d, 2 H, H arom., J = 10)
3b	DMSO-d_6	2.73 (s, 2 H, $COCH_2$); 3.95 (s, 2 H, NCH_2); 5.35 (s, 2 H, NCH_2N); 7.70—8.70 (m, 8 H, H arom.)
	$CDCl_3$	2.90 (s, 2 H, $COCH_2$); 4.10 (s, 2 H, NCH_2); 5.35 (s, 2 H, NCH_2N); 7.60—9.00 (m, 8 H, H arom.)
3c	DMSO-d_6	2.11 (s, 3 H, Me); 2.18 (s, 3 H, Me); 2.60—2.93 (m, 2 H, $COCH_2$); 3.30 (m, 1 H, NCH(2a)); 3.81 (m, 1 H, NCH(2b)); 7.02 (s, 1 H, NCHN); 7.35—7.50 (m, 5 H, H arom.)
	$CDCl_3$	2.15 (s, 3 H, Me); 2.20 (s, 3 H, Me); 2.68 (m, 1 H, COCH(2a)); 2.88 (m, 1 H, COCH(2b)); 3.49 (m, 1 H, NCH(2a)); 3.73 (m, 1 H, NCH(2b)); 7.20 (s, 1 H, NCHN); 7.42 (m, 5 H, H arom.)
3d	DMSO-d_6	2.65 (d, 1 H, COCH(2a), J = 10); 3.00 (1 H, COCH(2b)); 3.60—3.90 (m, 2 H, NCH_2); 7.20 (br.s, 1 H, NCHN); 7.50 (m, 12 H, H arom.); 7.70 (br.s, 1 H, H arom.); 7.91 (s, 2 H, H arom.)
3e	DMSO-d_6	2.12 (s, 3 H, Me); 2.20 (s, 3 H, Me); 2.60 (1 H, COCH(2a)); 2.95 (1 H, COCH(2b)); 3.35 (1 H, NCH(2a)); 3.85 (m, 1 H, NCH(2b)); 7.15 (s, 1 H, NCHN); 7.70 (m, 2 H, H arom.); 8.30 (m, 2 H, H arom.)
	$CDCl_3$	2.10—2.25 (br.s, 6 H, 2 Me); 2.72 (1 H, COCH(2a)); 2.90 (1 H, COCH(2b)); 3.46 (1 H, NCH(2a)); 3.80 (m, 1 H, NCH(2b)); 7.21 (br.s, 1 H, NCHN); 7.68 (m, 2 H, H arom.); 8.21 (m, 2 H, H arom.)
3f	DMSO-d_6	2.71 (m, 1 H, COCH(2a)); 3.00 (m, 1 H, COCH(2b)); 3.35 (m, 1 H, NCH(2a)); 3.89 (m, 1 H, NCH(2b)); 7.28 (s, 1 H, NCHN); 7.53 (m, 7 H, H arom.); 7.70 (t, 1 H, H arom., J = 10); 7.92 (m, 4 H, H arom.); 8.43 (d, 2 H, H arom., J = 10)
3g	$CDCl_3$	2.15 (s, 3 H, Me); 2.29 (s, 3 H, Me); 2.70 (m, 1 H, COCH(2a)); 2.88 (1 H, COCH(2b)); 3.49 (1 H, NCH(2a)); 3.68 (m, 1 H, NCH(2b)); 3.82 (s, 3 H, OMe); 6.90—7.05 (m, 4 H, H arom.); 7.30 (s, 1 H, NCHN)
3h	DMSO-d_6	2.60—2.80 (m, 2 H, $COCH_2$); 3.50—3.80 (m, 2 H, NCH_2); 3.88 (s, 3 H, OMe); 7.05—8.05 (m, 15 H, H arom. + NCHN)
5a	DMSO-d_6	2.06 (br.s, 2 H, $COCH_2$); 2.40 (s, 3 H, Me); 2.46 (s, 3 H, Me); 3.70 (br.s, 2 H, NCH_2); 5.15 (s, 2 H, NCH_2N); 7.42 (d, 2 H, H arom., J = 10); 7.50 (d, 2 H, H arom., J = 10); 7.65 (d, 2 H, H arom., J = 10); 7.83 (d, 2 H, H arom., J = 10)
5b	DMSO-d_6	2.30—2.50* ($COCH_2$); 3.12 (1 H, NCH(2a)); 3.82 (1 H, NCH(2b)); 6.77 (br.s, 1 H, NCHN); 7.18—8.10 (m, 13 H, H arom.)
5c	$CDCl_3$	2.20—2.40 (m, 2 H, $COCH_2$); 2.48 (s, 3 H, Me); 2.55 (s, 3 H, Me); 3.00 (m, 1 H, NCH(2a)); 3.85 (m, 1 H, NCH(2b)); 7.03 (s, 1 H, NCHN); 7.28 (d, 2 H, H arom., J = 10); 7.35 (d, 2 H, H arom., J = 10); 7.47 (d, 2 H, H arom., J = 10); 7.76 (d, 2 H, H arom., J = 10); 8.02 (d, 2 H, H arom., J = 10); 8.25 (d, 2 H, H arom., J = 10)
7a	DMSO-d_6	2.67 (t, 2 H, $COCH_2$, J = 8); 3.85 (t, 2 H, NCH_2, J = 8); 5.22 (s, 2 H, NCH_2N); 7.00—7.13 (m, 2 H, H arom.); 7.25—7.40 (m, 4 H, H arom.); 7.54 (t, 4 H, H arom., J = 10); 9.12 (s, 1 H, NH); 10.40 (s, 1 H, NH)
7b	DMSO-d_6	2.67 (br.s, 2 H, $COCH_2$); 3.85 (m, 2 H, NCH_2); 5.21 (br.s, 2 H, NCH_2N); 7.25—7.60 (m, 8 H, H arom.); 9.18 (s, 1 H, NH); 10.55 (s, 1 H, NH)
7c	DMSO-d_6	2.72 (s, 2 H, $COCH_2$); 3.92 (s, 2 H, NCH_2); 5.30 (s, 2 H, NCH_2N); 7.70—7.83 (m, 4 H, H arom.); 8.22 (m, 4 H, H arom.); 9.70 (s, 1 H, NH); 11.10 (s, 1 H, NH)

* The signal overlaps with the signal from the solvent.

Scheme 8



2-nonsubstituted and 2-aryl-substituted HTHP, these signals are observed at δ 5.05—5.35 and 6.8—7.3, respectively) and the signals for the C(2) atoms in the ^{13}C NMR spectra of HTHP (δ 63—73) are the most informative.

In conclusion, it should be noted that in spite of the fact that the structures of HTHP and HDHQ are substantially similar, their reactions with the electrophilic reagents under study have virtually no analogies.

Experimental

The ^{1}H and ^{13}C NMR spectra were recorded on a Bruker AM-300 instrument relative to Me_4Si (the internal standard). Signals for the protons, whose multiplicities are not given, are substantially broadened (apparently, due to dynamic processes). Their fine structures were not observed (for some compounds,

Table 3. ^{13}C NMR spectra of some *N,O*-diacylated HTHP (DMSO-d_6)*

Compound	δ
3c	17.8 (CH_3); 20.9 (CH_3); 32.5 ($CO\underline{C}H_2$); 37.7 (NCH_2); 69.7 (NCHN); 126.3, 128.6, 136.7 (CH arom.); 163.9 (CO); 166.9 (CO); 168.5 (CO)
3d	32.6 ($CO\underline{C}H_2$); 72.1 (NCHN); 126.1, 126.5, 126.8, 128.6, 128.8, 129.0, 129.4, 130.3, 134.1, 134.4, 136.3 (CH arom.); 162.4 (CO); 164.4 (CO); 169.1 (CO)
3f	32.7 ($CO\underline{C}H_2$); 39.3 (NCH_2)**; 71.9 (NCHN); 123.8, 126.3, 126.9, 128.2, 128.6, 128.9, 129.5, 130.5, 134.0, 134.4, 143.6, 148.0 (CH arom.); 162.5 (CO); 164.4 (CO); 169.4 (CO)
3g**	18.1 (CH_3); 21.0 (CH_3); 33.4 ($CO\underline{C}H_2$); 38.1 (NCH_2); 55.8 (OCH_3); 66.7 (NCHN); 114.0, 114.9, 124.6, 128.9, 142.0 (CH arom.); 157.43 ($CH_3O\underline{C}$, CH arom.); 162—170 (CO)
3h	33.1 ($CO\underline{C}H_2$); 55.6 (OCH_3); 67.4 (NCHN); 113.4, 115.0, 124.7, 126.1, 126.7, 128.4, 128.7, 129.0, 129.3, 129.4, 129.8, 130.3, 133.6, 134.5, 141.9 (CH arom.); 157.0 ($CH_3O\underline{C}$, CH arom.); 162.3 (CO); 164.7 (CO); 164.8 (CO); 169.0 (CO)
7a	32.3 ($CO\underline{C}H_2$); 62.8 (NCH_2N); 118.1, 120.0, 121.7, 122.5, 128.4, 128.7 (CH arom.); 139.7 (CO); 154.6 (CO); 165.0 (CO)

* In the cases of **3d,f,h** and **7a**, the signals from CH_2N (δ 38—39) overlap with the signal from the solvent (δ 38—41).
** Determined by the $\{^1H\}$—^{13}C double resonance method.
***$CDCl_3$ was used as the solvent.

$\nu_{1/2}$ reached 50—75 Hz). The melting points were determined on a Kofler stage. The initial HTHP were prepared according to a known procedure.[2]

General procedure for the preparation of 1-acyl-3-acyloxytetrahydropyrimidin-4-ones (3a—f) and 1-tosyl-3-tosyloxytetrahydropyrimidin-4-ones (5a—c). Pyridine (2 mmol, 0.18 mL) and then acid chloride (2 mmol) were added to a solution of the corresponding HTHP (1 mmol) in 1,4-dioxane (5 mL). The resulting mixture was stirred at ~20 °C for 4 h in the case of compounds **3a—f** or for 6 h in the case of **5a—c**. The solvent was evaporated and the resulting mixture was recrystallized. Compounds **3a,b,d** were recrystallized from aqueous ethanol. Compounds **3c,e** were recrystallized from water. Compounds **3f** and **5a—c** were recrystallized from ethanol. The yields and the physicochemical properties of the products are given in Tables 1—3.

1-Acetyl-3-acetyloxy-2-(3-methoxyphenyl)tetrahydropyrimidin-4-one (3g) and 1-benzoyl-3-benzoyloxy-2-(3-methoxyphenyl)tetrahydropyrimidin-4-one (3h) were prepared analogously to compounds **3a—f** from 3-(3-methoxybenzylideneamino)propionohydroxamic acid. Compounds **3g** and **3h** were recrystallized from water and ethanol, respectively. Their yields and the physicochemical properties are given in Tables 1—3.

1-Arylcarbamoyl-3-arylcarbamoyloxytetrahydropyrimidin-4-ones (7a,b). The corresponding aryl isocyanate (2 mmol) was added to a solution of compound **1a** (1 mmol) in 1,4-dioxane (5 mL). The reaction mixture was stirred at ~20 °C for 4 h. The precipitate that formed was filtered off, washed with ether (2×5 mL), and recrystallized from ethanol. The yields and the physicochemical properties of the products are given in Tables 1—3.

1-(4-Nitrophenylcarbamoyl)-3-(4-nitrophenylcarbamoyloxy)tetrahydropyrimidin-4-one (7c). 4-$NO_2C_6H_4CON_3$ [3] (2 mmol) was added to a solution of compound **1a** (1 mmol) in 1,4-dioxane (5 mL) and the reaction mixture was refluxed for 4 h. The precipitate that formed was filtered off, washed with hot ethanol, and recrystallized from Pr^iOH.

1-Chloroacetyl-3-hydroxy-2-phenyltetrahydropyrimidin-4-one (4a) was prepared analogously to compounds **3a—f** from 2-phenyl-substituted HTHP **(1b)** and 1 equiv. of $ClCH_2COCl$ in the presence of pyridine and recrystallized from water. The yield was 13%, m.p. 77—79 °C. ^1H NMR (DMSO-d_6), δ: 2.45* (COCH(2a)); 2.82 (1 H, COCH(2b)); 3.35 (1 H, NCH(2a)); 3.76 (1 H, NCH(2b)); 4.61 (s, 2 H, CH_2Cl); 6.84 (s, 1 H, NCHN); 7.40—7.50 (m, 5 H, H arom.); 10.15 (s, 1 H, OH).

3-Chloroacetyl-3-hydroxy-1-(4-nitrophenyl)tetrahydropyrimidin-4-one (4b) was prepared analogously to **4a**. The yield was 28%, m.p. 160—162 °C. Found (%): C, 44.75; H, 4.22; Cl, 11.52. $C_{12}H_{12}N_3O_5Cl$. Calculated (%): C, 45.95; H, 3.86; Cl, 11.30. ^1H NMR (DMSO-d_6), δ: 2.5* (COCH(2a)); 2.88 (1 H, COCH(2b)); 3.28 (1 H, NCH(2a)); 3.82 (1 H, NCH(2b)); 4.65 (s, 2 H, CH_2Cl); 6.89 (s, 1 H, NCHN); 7.63 (s, 2 H, H arom.); 8.30 (s, 2 H, H arom.); 10.31 (s, 1 H, OH).

1-Acetyl-3-hydroxy-2-phenyltetrahydropyrimidin-4-one (8a). Gaseous NH_3 was slowly passed through a solution of compound **3c** (0.2 g) in MeOH (4 mL) at ~20 °C for 3 h. The solvent was evaporated and the residue was recrystallized from benzene. Compound **8a** was obtained in 70% yield, m.p. 156—158 °C. Found (%): C, 60.21; H, 6.34. $C_{12}H_{14}N_2O_3$. Calculated (%): C, 61.53; H, 6.02. ^1H NMR (DMSO-d_6), δ: 2.14 (s, 3 H, Me); 2.40 (1 H, COCH(2a)); 2.76 (1 H, COCH(2b)); 3.18 (1 H, NCH(2a)); 3.72 (br.s, 1 H, NCH(2b)); 6.89 (s, 1 H, NCHN); 7.30—7.50 (m, 5 H, H arom.); 10.09 (br.s, 1 H, OH). ^1H NMR ($CDCl_3$), δ: 2.20 and 2.45 (both br.s, 3 H, Me); 2.75 (2 H, $COCH_2$); 3.40 (1 H, NCH(2a)); 3.70 (1 H, NCH(2b)); 7.20—7.45 (br.s, 6 H, H arom.).

1-Benzoyl-3-hydroxy-2-phenyltetrahydropyrimidin-4-one (8b) was prepared analogously from **3d**. The yield was 40%, m.p. 148—149 °C. Found (%): C, 68.36; H, 5.82. $C_{17}H_{16}N_2O_3$. Calculated (%): C, 68.91; H, 5.44. ^1H NMR ($CDCl_3$), δ: 2.55—2.90 (m, 2 H, $COCH_2$); 3.28 (1 H, NCH(2a)); 3.88 (1 H, NCH(2b)); 7.30—7.60 (m, 11 H, H arom.).

1-Acetyl-3-hydroxy-2-(4-nitrophenyl)tetrahydropyrimidin-4-one (8c) was prepared analogously from **3e**. The yield was 47%, m.p. 182—183 °C. ^1H NMR (DMSO-d_6), δ: 2.15 (s, 3 H, Me); 2.78 (1 H, COCH(2a)); 3.16 (1 H, COCH(2b)); 3.33 (1 H, NCH(2a)); 3.80 (1 H, NCH(2b)); 6.92 (br.s, 1 H, NCHN); 7.60 (br.s, 2 H, H arom.); 8.30 (br.s, 2 H, H arom.); 10.25 (br.s, 1 H, OH). ^1H NMR ($CDCl_3$), δ: 2.30 and 2.43

* The signal overlaps with the peak of the solvent.

(both br.s, 3 H, Me); 2.80 (2 H, $COCH_2$); 3.35 (1 H, NCH(2a)); 3.79 (1 H, NCH(2b)); 7.37 (1 H, NCHN); 7.60 (br.s, 2 H, H arom.); 8.40 (br.s, 2 H, H arom.).

N,O*-Dibenzoyl-3-aminopropionohydroxamic acid (10).** ***A. Pyridine (2 mmol, 0.18 mL) and then BzCl (2 mmol) were added to a solution of 3-aminopropionohydroxamic acid[4] (**12**) (1 mmol) in 1,4-dioxane (5 mL). The resulting mixture was stirred at ~20 °C for 4 h, the solvent was evaporated, and the residue was recrystallized from water. The yield was 48%, m.p. 149—151 °C. Found (%): C, 65.50; H, 5.14. $C_{17}H_{16}N_2O_4$. Calculated (%): C, 65.38; H, 5.16. ^{1}H NMR (DMSO-d_6), δ: 2.60 (br.s, 2 H, $COCH_2$); 3.58 (br.s, 2 H, NCH_2); 7.40—8.30 (m, 10 H, H arom.).

B. Acid **10** was prepared analogously to **3a—f** from 2,2-dimethyl-substituted HTHP (**1d**) and BzCl and from 1-hydroxy-1,5-diazaspiro[5.5]undecan-2-one (**1e**) and BzCl. The yields were 42% and 40%, respectively, m.p. 149—151 °C.

N,O*-Bis(phenylcarbamoyl)-3-aminopropionohydroxamic acid (11).** ***A. PhNCO (2 mmol) was added to a solution of 3-aminopropionohydroxamic acid (**12**) (1 mmol) in 1,4-dioxane (5 mL). The reaction mixture was stirred at ~20 °C for 4 h. The precipitate that formed was filtered off, washed with ether (2×5 mL), and recrystallized from Pr^iOH. The yield was 58%, m.p. 167—169 °C. Found (%): C, 60.04; H, 4.89. $C_{17}H_{18}N_4O_4$. Calculated (%): C, 59.64; H, 5.30. ^{1}H NMR (DMSO-d_6), δ: 2.40 (m, 2 H, $COCH_2$); 3.35 (m, 2 H, NCH_2); 6.50 (s, 1 H, NH); 6.80—7.50 (m, 10 H, H arom.); 8.92 (s, 1 H, NH); 10.19 (s, 1 H, NH).

B. Acid **11** was prepared analogously to **7a—c** from 2,2-dimethyl-substituted HTHP (**1d**) and PhNCO. The yield was 45%, m.p. 167—168 °C.

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