Pteridines

Part CXIX[1])

A New Pteridine–Purine Transformation

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A variety of pyrimidine precursors **12**–**25** were converted into a series of new 7-hydroxylumazines (=7-hydroxypteridine-2,4(1*H*,3*H*)-diones) **26**–**35** which functioned as starting materials for the transformation into the corresponding 7-chlorolumazines **36**–**45**. Subsequent reaction with hydrazine led to the 7-hydrazinolumazines **46**–**55** which gave on nitrosation the 7-azidolumazines **1** and **56**–**64**. These compounds were subjected to short heating in xylene whereby **1** and **56**–**61** showed a new pteridine–purine interconversion in forming a new type of 1,3-disubstituted or 3-substituted xanthin-8-amine-derived nitrilium ylides (2,3,6,7-tetrahydro-*N*-methylidyne-2,6-dioxo-1*H*-purin-8-aminium ylides) **11** and **65**–**70**. The presence of an additional 6-alkyl substituent in the 7-azidolumazines **63** and **64** or of an unsubstituted N(3) position in **62** caused further rearrangement to xanthine-9-carbonitriles **71**–**73**. Prolonged heating of 7-azido-1,3-dimethyllumazine (**1**) also afforded theophylline-9-carbonitrile (=1,2,3,6-tetrahydro-1,3-dimethyl-2,6-dioxo-9*H*-purine-9-carbonitrile; **5**). The nitrilium ylide function was established by NMR and UV spectra as well as by elemental analyses. Confirmation of the nitrilium ylide structures was suggested by the result of the heating of 1,3-dimethyl-*N*-methylidynexanthin-8-aminium ylide **11** in EtOH or of **1** in pentan-1-ol leading to 8-aminotheophylline (=8-amino-3,7-dihydro-1,3-dimethyl-1*H*-purin-2,6-dione; **74**).

1. Introduction. – The chemistry of nitrilium ylides [2] has been under investigation for more then 40 years and revealed numerous syntheses which generate this reactive function under a variety of conditions [3–6]. It is generally agreed that only in special cases, a stable isolable nitrilium ylide can be expected due to the high reactivity of this functionality in 1,3-dipolar cycloaddition reactions and towards nucleophiles. The synthesis of a stable nitrilium ylide could be achieved by *Janulis* and *Arduengo* [7] during photolysis of diazotetrakis(trifluoromethyl)cyclopentadiene in presence of adamantane-1-carbonitrile to form adamantane-1-carbonitrilium 2,3,4,5-tetrakis(trifluoromethyl)cyclopenta-2,4-dien-1-ylide (=*N*-(adamantan-1-ylmethylidyne)-2,3,4,5-tetrakis(trifluoromethyl)cyclopenta-2,4-dien-1-aminium ylide) which was crystallized and its structure established unequivocally by X-ray structure determination [8]. This result is not unexpected in view of the anion-stabilizing ability of the tetrakis(trifluoromethyl)cyclopentadienylide moiety as well as the steric bulk of the adamantyl residue. The first example of a thermally generated nitrilium ylide is derived from 5-

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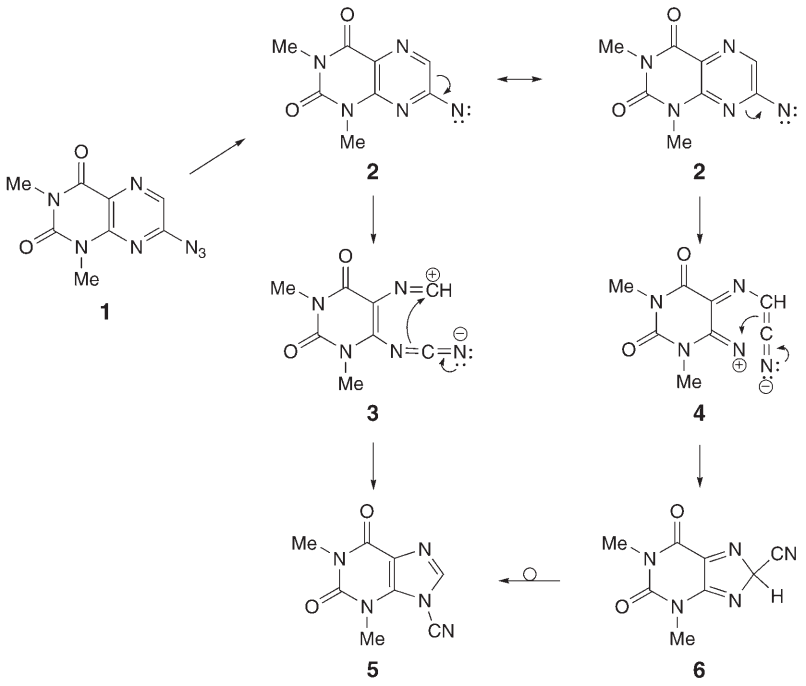
(*tert*-butyl)-2,3-dihydro-2,2,2-trimethoxy-3,3-bis(trifluoromethyl)-1,4,2,λ^5-oxazaphosphole by vacuum flash pyrolysis at 400°/10^{-3} Torr and matrix isolation at −196° [9].

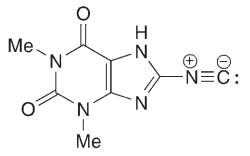
Our interest in nitrilium ylides arose more or less accidentially during studies of various 7-azidolumazine derivatives which turned out to rearrange in the solid state and in inert solvents on heating [10]. We noticed that 7-azido-1,3-methyllumazine (= 7-azidopteridine-2,4(1*H*,3*H*)-dione; **1**) converts on drying at 100° in the oven in a solid-state reaction without change of its habitus into a new product which was identified as theophylline-9-carbonitrile (= 1,3-dimethylxanthine-9-carbonitrile = 1,2,3,6-tetrahydro-1,3-dimethyl-2,6-dioxo-9*H*-purine-9-carbonitrile; **5**) (*Scheme 1*). We assume that this new pteridine–purine ring contraction proceeds most likely *via* the intermediate nitrene **2** followed by a 'zwittazido' cleavage [11][12] to the intermediates **3** and **4** respectively, which can cyclize in one step to 1,3-dimethylxanthine-9-carbonitrile (**5**) or *via* the 8-carbonitrile isomer **6** and a subsequent 1,5-sigmatropic shift of the functional group.

Scheme 1



There are already some literature precedences of analogous ring contractions of 2-azidopyrazines into *1*H-imidazole-1-carbonitriles [13–15]. Ring expansion and ring contraction of arylcarbenes and arylnitrenes is a subject of longstanding interest, especially in the group of *Wentrup* [16][17] and others [18–20]. We will add to this exiting field our results and describe here the experiments in detail which led to a new type of stable nitrilium ylides [10].

2. Syntheses and Results. – In a second experiment, we heated 7-azido-1,3-dimethyllumazine (**1**) in xylene under reflux and obtained a relatively insoluble material isomeric with **5** according to elemental analysis and the distinct differences in UV and IR spectra. Treatment of this product in H_2O or BuOH led to 8-amino-theophylline (= 8-amino-1,3-dimethylxanthine) indicating that another pyrazine-ring contraction has taken place on heating of **1** in an aprotic solvent. The NMR spectrum in (D_6)DMSO established that the structure of theophyllin-8-yl isocyanide (= 8-isocyano-1,3-dimethylxanthine; **7**) had to be excluded as a structural possibility due to the presence of a *s* at δ 8.58 which is rather a CH than a NH signal considering its stability in a D_2O-exchange experiment. Since heterocyclic azides [21–28] show a broad variety of reactions, the structures of a cyclic carbodiimide **8**, a condensed 1,3-diazeto[1,2-*f*]purine derivative **9**, a spiro compound **10**, or a resonance-stabilized nitrilium ylide **11** could not *a priori* be eliminated. It was obvious that the solution of this structural problem would arise from spectral data and comparisons with model substances. From the IR spectrum which exhibits a characteristic band at 2180 cm^{-1}, we concluded that the cyclic carbodiimide **8**, the tricyclic ring system **9**, and the spiro structure **10** were very much unlikely, leaving the resonance-stabilized nitrilium ylide **11** as the most favourable structure for the isomer of **5**. The UV spectrum in MeOH shows two strong absorption bands at 234 and 295 nm and a shoulder at 259 nm which resembled best the data of 8-ethynyltheophylline [29] as the closest structural analog.



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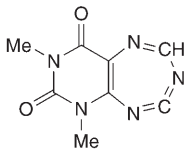

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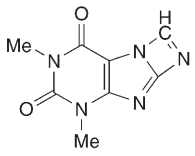

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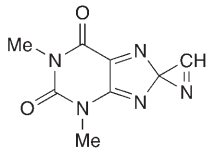

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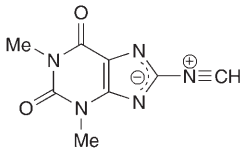

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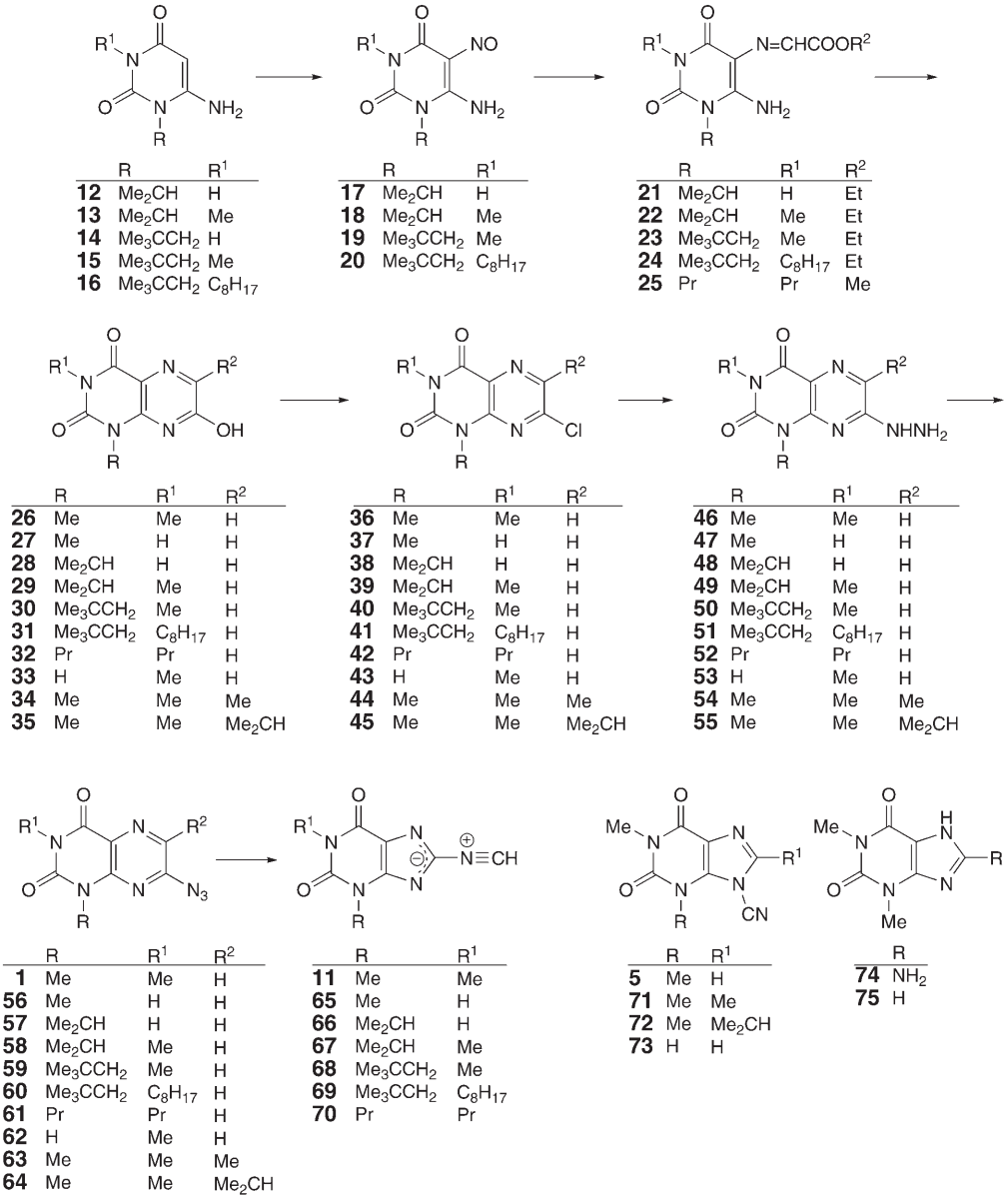
More 7-azidolumazines, *i.e.*, **56**–**64**, were synthesized by the same sequence of reactions starting from the appropriate known and new 1-substituted and 1,3-disubstituted 6-aminouracils (= 6-aminopyrimidine-2,4(1*H*,3*H*)-diones) **12**–**16** first by nitrosation (→ **17**–**20**), followed by reduction to the 5,6-diamino derivatives which were condensed with ethyl or methyl glyoxylate (= ethyl or methyl 2-oxoacetate) (→ **21**–**25**) and ethyl pyruvate (= ethyl 2-oxopropanoate) forming, on ring closure, the 7-hydroxylumazines **26**–**35** (*Scheme 2*). Reaction with $POCl_3$ led to the corresponding 7-chlorolumazines **36**–**45** which on treatment with hydrazine showed easy nucleophilic displacement of the Cl-atom to give **46**–**55**. Finally, $NaNO_2$ treatment in acidic medium yielded the 7-azidolumazines **1** and **56**–**64**.

Scheme 2



	R	R^1
12	Me_2CH	H
13	Me_2CH	Me
14	Me_3CCH_2	H
15	Me_3CCH_2	Me
16	Me_3CCH_2	C_8H_{17}

	R	R^1
17	Me_2CH	H
18	Me_2CH	Me
19	Me_3CCH_2	Me
20	Me_3CCH_2	C_8H_{17}

	R	R^1	R^2
21	Me_2CH	H	Et
22	Me_2CH	Me	Et
23	Me_3CCH_2	Me	Et
24	Me_3CCH_2	C_8H_{17}	Et
25	Pr	Pr	Me

	R	R^1	R^2
26	Me	Me	H
27	Me	H	H
28	Me_2CH	H	H
29	Me_2CH	Me	H
30	Me_3CCH_2	Me	H
31	Me_3CCH_2	C_8H_{17}	H
32	Pr	Pr	H
33	H	Me	H
34	Me	Me	Me
35	Me	Me	Me_2CH

	R	R^1	R^2
36	Me	Me	H
37	Me	H	H
38	Me_2CH	H	H
39	Me_2CH	Me	H
40	Me_3CCH_2	Me	H
41	Me_3CCH_2	C_8H_{17}	H
42	Pr	Pr	H
43	H	Me	H
44	Me	Me	Me
45	Me	Me	Me_2CH

	R	R^1	R^2
46	Me	Me	H
47	Me	H	H
48	Me_2CH	H	H
49	Me_2CH	Me	H
50	Me_3CCH_2	Me	H
51	Me_3CCH_2	C_8H_{17}	H
52	Pr	Pr	H
53	H	Me	H
54	Me	Me	Me
55	Me	Me	Me_2CH

	R	R^1	R^2
1	Me	Me	H
56	Me	H	H
57	Me_2CH	H	H
58	Me_2CH	Me	H
59	Me_3CCH_2	Me	H
60	Me_3CCH_2	C_8H_{17}	H
61	Pr	Pr	H
62	H	Me	H
63	Me	Me	Me
64	Me	Me	Me_2CH

	R	R^1
11	Me	Me
65	Me	H
66	Me_2CH	H
67	Me_2CH	Me
68	Me_3CCH_2	Me
69	Me_3CCH_2	C_8H_{17}
70	Pr	Pr

	R	R^1
5	Me	H
71	Me	Me
72	Me	Me_2CH
73	H	H

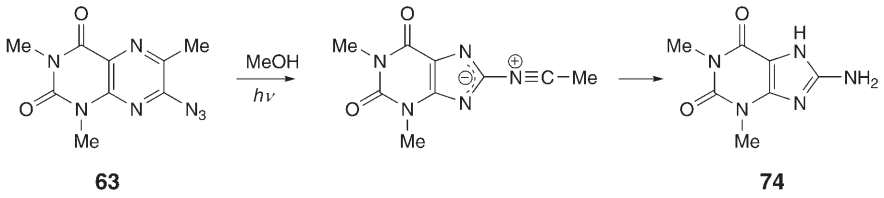
	R
74	NH_2
75	H

Thermolysis of **56**–**64** proceeded in an analogous manner to that of **1**, leading to the nitrilium ylides **65**–**70** of which the 1-isopropyl-3-methyl-, the 1-neopentyl-3-methyl-, the 1-neopentyl-3-octyl-, and the 1,3-dipropylxanthin-8-aminium ylides (= nitrilium ylides) **67**–**70** showed much better solubilities than the 1,3-dimethyl-substituted **11**,

thus improving handling. The presence of an additional alkyl substituent at C(6) of the 7-azidolumazines **63** and **64** or the removal of the N(1) substituent such as in **62** did not favor the nitrilium ylide formation but led to the corresponding xanthine-9-carbonitriles **71**–**73**.

In the case of 7-azido-1,3,6-trimethyllumazine (**63**), the formation of the corresponding nitrilium ylide could only be detected on photolysis in MeOH as an intermediate which was further hydrolyzed to give 8-aminotheophylline **74** (*Scheme 3* and *Fig.*).

Scheme 3



63 **74**

More structural information was finally obtained from the ^{13}C-NMR spectra which were in excellent agreement with the proposed stable nitrilium ylide structures **11** and **65**–**70**. The well-soluble nitrilium ylide **69**, in a gated decoupling experiment in $CDCl_3$, exhibits a ^{1}H,^{13}C coupling constant of 246 Hz for the signal at δ(C) 145.5 which is due to the nitrilium moiety of the molecule, thus establishing directly this unusual structure. Another long-range coupling ($J = 10$ Hz) is observed for the signal at δ(C) 110.1 which has to be assigned logically to the C(8) atom. Comparisons of the ^{13}C-NMR spectra of the purinium betaine structures with those of the other xanthine derivatives (*Table*) reveal the different electron distributions in both systems showing close similarities only at C(2), C(4), and C(6), whereas in the zwitterion molecules, the chemical shifts of C(5) are moved downfield to some extent, and C(8) is shifted tremendously upfield indicating a relatively high electron density at this center.

Regarding the mechanism of the nitrilium ylide formation, we assume first cleavage of the nitrene such as **2** to **3** which shows an electrocyclization to **8** followed by a valence tautomerism to **9** and finally ring opening to **11**.

3. Conclusions. – The unusually high thermodynamical stability of the new type of heterocyclic nitrilium ylides is due to a strong resonance stabilization of the negatively charged anion moiety of the molecules which can be described by a series of resonance structures (*Scheme 4*).

With the zwitterions of type **11** we have isolated for the first time stable nitrilium ylides which do not require a further bulky substituent at the nitrilium C-atom to counteract secondary reactions.

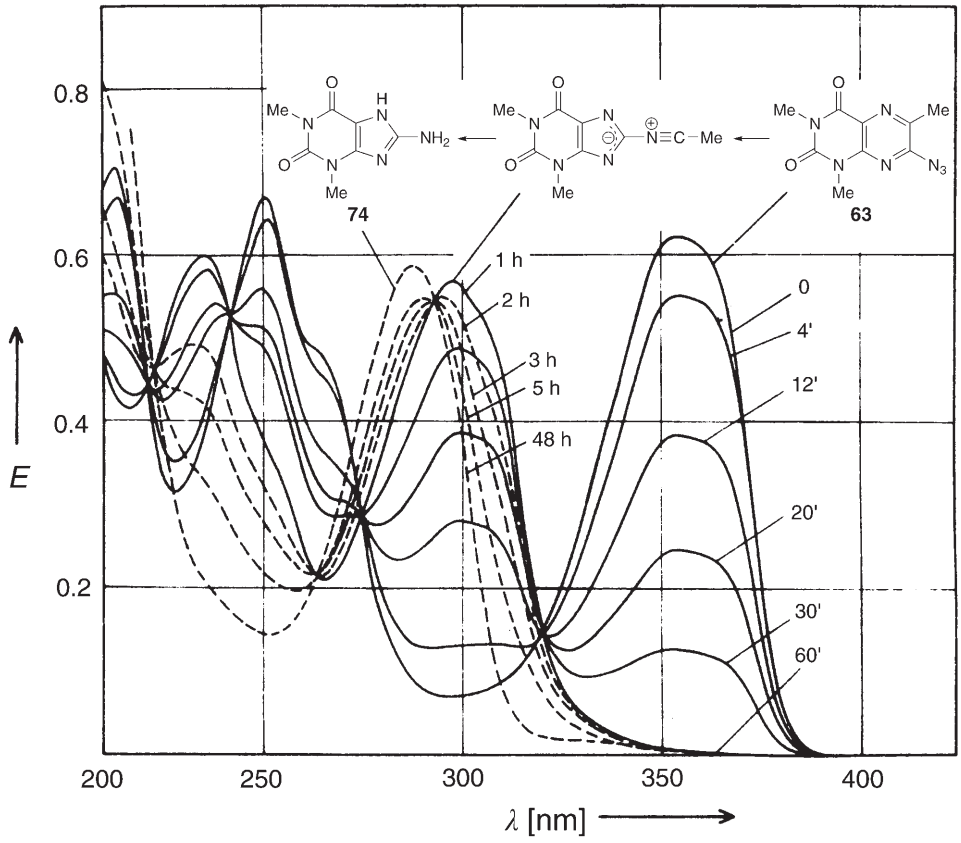


Figure. *Photolysis of 7-azido-1,3,6-trimethyllumazine* (**63**) *in MeOH*

Scheme 4

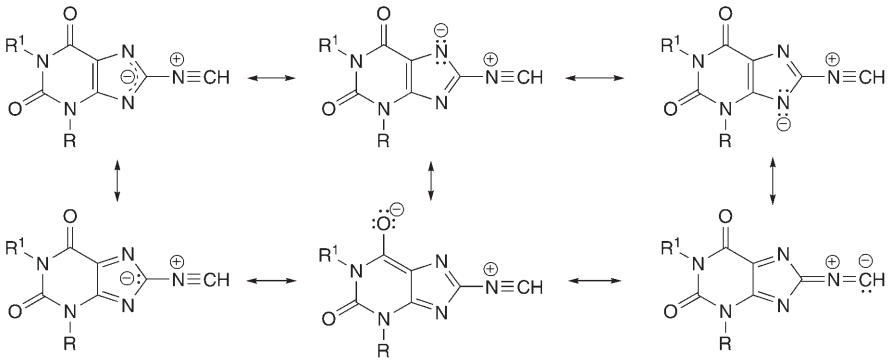


Table. *Spectral Data of Theophylline* (**75**) *and Purin-8-aminium Ylide Derivatives*

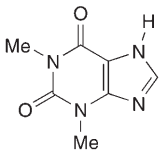
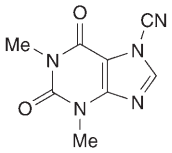
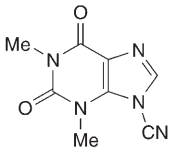
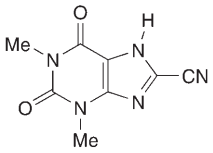
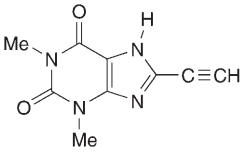
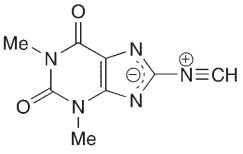
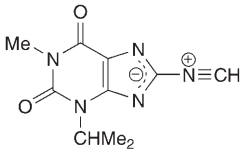
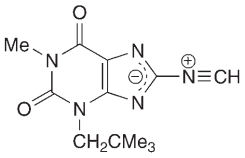
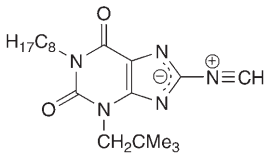
		UV (MeOH)		IR	^{13}C-NMR ((D$_6$)DMSO)					
		λ_{max} [nm]	log ε	[cm^{-1}]	C(6)	C(2)	C(4)	C(8)	C(5)	X≡C
	**75**	270	4.02		154.0	150.9	147.5	139.9	106.1	
		230 (sh), 283	3.85, 3.84	2258	152.7	150.7	147.3	146.0	106.8	103.0
	**5**	245, 260 (sh)	4.00, 3.94	2260	155.7	149.9	137.2	140.0	114.6	103.0
		218, 296	4.38, 4.12	2220	154.0	150.6	146.5	121.1	111.4	110.3
		222, 246 (sh), 294	4.40, 3.63, 4.25	2140	153.7	150.9	147.0	131.8	107.2	84.0, 73.5
	**11**	234, 250 (sh), 295	4.22, 3.95, 4.21	2180	156.9	154.9	147.8	109.4	114.2	146.5
	**67**	237, 250 (sh), 296	4.19, 3.97, 4.19	2200	156.9	154.9	147.8	109.4	114.2	146.6

Table (cont.)

		UV (MeOH)		IR	^{13}C-NMR ((D$_6$)DMSO)					
		λ_{max} [nm]	log ε	[cm^{-1}]	C(6)	C(2)	C(4)	C(8)	C(5)	X≡C
	**68**	237, 250 (sh), 297	4.19, 3.98, 4.19	2129	157.6	154.1	149.1	109.5	114.3	146.8
	**69**	228, 250 (sh), 297	4.22, 3.98, 4.25	2180	157.7	152.7	148.8	110.1	114.5	145.5

Experimental Part

General. TLC: precoated cellulose thin-layer sheets *F 1440b LS 254* and silica gel thin-layer sheets *F 1500 LS 254* from *Schleicher & Schüll*. Prep. TLC: silica gel *60 PF 254* from *Merck*. M.p.: *Büchi-B-545* melting point apparatus; no corrections. pK_a Values: measurements by the spectrophotometric method [30]. UV: *Perkin-Elmer-Lambda-15* spectrometer; λ_{max} (log ε) in nm, sh = shoulder. ^{1}H-NMR: *Bruker-WM-250* spectrometer; δ in ppm rel. to Me$_4$Si, *J* in Hz.

*7-Azido-1,3-dimethylpteridine-2,4(1*H*,3*H*)-dione* (**1**). To a suspension of 7-hydrazinyl-1,3-dimethylpteridine-2,4(1*H*,3*H*)-dione (**46**; 2.22 g, 10 mmol) in H_2O (100 ml) was added $NaNO_2$ (0.8 g, 11.6 mmol) with stirring and then dropwise conc. HCl soln. (2 ml). The solid was changing without the intermediate formation of a soln. and was filtered off after 30 min, washed with EtOH and Et_2O, and dried in a vacuum desiccator: 1.9 g (81%) of **1**. Crystal powder. M.p. 155°. UV (MeOH): 218 (4.24), 253 (4.14), 268 (sh, 3.98), 300 (3.46), 350 (4.18). ^{1}H-NMR ((D$_6$)DMSO): 8.25 (*s*, H–C(6)); 3.51 (*s*, Me–N(1)); 3.31 (*s*, Me–N(3)). Anal. calc. for $C_8H_7N_7O_2$ (233.2): C 41.20, H 3.03, N 42.05; found: C 41.38, H 3.34, N 42.09.

*1,2,3,6-Tetrahydro-1,3-dimethyl-2,6-dioxo-9*H*-purine-9-carbonitrile* (**5**). A soln. of **1** (1.0 g, 4.3 mmol) in abs. xylene (100 ml) was heated under reflux for 30 min. After 5 min refluxing, a brownish precipitate started to separate, which was filtered off after cooling to give 0.45 g of **11**. The filtrate was concentrated and the residue recrystallized from EtOH (50 ml) with charcoal: 0.12 g (14%) of **5**. Colorless needles. M.p. 218–220°. UV (MeOH): 245 (4.00), 260 (sh, 3.94). ^{1}H-NMR ((D$_6$)DMSO): 8.53 (*s*, H–C(8)); 3.66 (*s*, Me–N(1)); 3.25 (*s*, Me–N(3)). Anal. calc. for $C_8H_7N_5O_2$ (205.2): C 46.83, H 3.44, N 34.12; found: C 46.70, H 3.39, N 34.10.

*2,3,6,7-Tetrahydro-1,3-dimethyl-*N*-methylidyne-2,6-dioxo-1*H*-purin-8-aminium Inner Salt* (**11**). For 30 min, **1** (0.8 g, 3.4 mmol) was heated under reflux in dry xylene (30 ml). A precipitate separated from the clear soln. after 5–10 min. The solid was collected from the hot soln., washed with Et_2O and dried in a vacuum desiccator: 0.49 g (70%) of **11**. Crystal powder. M.p. 250–253°. UV (MeOH): 234 (4.22), 250 (sh, 3.95), 295 (4.21). ^{1}H-NMR ((D$_6$)DMSO): 8.62 (*s*, C–H); 3.48 (*s*, Me–N(3)); 3.36 (*s*, Me–N(1)). Anal. calc. for $C_8H_7N_5O_2$ (205.2): C 46.83, H 3.44, N 34.12; found: C 46.49, H 3.30, N 34.01.

*6-Amino-1-isopropylpyrimidine-2,4(1*H*,3*H*)-dione* (**12**) [31]. Isopropylurea (10.2 g, 0.1 mol) was dissolved in 3N NaOEt soln. (100 ml) and heated under reflux. Then 2-cyanoacetic acid methyl ester (11 ml, 0.11 mol) was added dropwise, and the mixture was heated for 4 h. After evaporation, the residue was dissolved in H_2O (100 ml), the soln. acidified with AcOH to pH 5 and continuously extracted with AcOEt, the extract evaporated, and the residue recrystallized from acetone: 8.5 g (60%) of **12**. Colorless

crystals. M.p. 248°. UV (MeOH): 269 (4.46). ^{1}H-NMR ((D$_6$)DMSO): 10.35 (br. *s*, H–N(3)); 6.71 (br. *s*, NH$_2$): 4.69 (*s*, H–C(5)); 4.48 (*q*, Me$_2$C*H*); 1.41 (*d*, *Me*$_2$CH). Anal. calc. for $C_7H_{11}N_3O_2$ (169.2): C 49.70, H 6.60, N 24.80; found: C 49.72, H 6.85, N 24.85.

*6-Amino-1-isopropyl-3-methylpyrimidine-2,4(1*H,*3*H*)-dione* (**13**) [32]. A soln. of **12** (1.69 g, 10 mmol) in 1N NaOH (10 ml) was treated at 35° dropwise with dimethyl sulfate (1.1 ml). After stirring for 1 h, the precipitate was collected (0.85 g) and the filtrate extracted several times with $CHCl_3$. The $CHCl_3$ layer was dried (Na_2SO_4), and concentrated and the residue combined with the first crop (0.85 g) and recrystallized from H_2O: 1.38 g (75%) of **13**. Colorless crystals. M.p. 208°. ([32]: 210–212°). UV (MeOH): 269 (4.48). ^{1}H-NMR ((D$_6$)DMSO): 6.70 (br. *s*, NH$_2$); 4.68 (*s*, H–C(5)); 4.50 (*q*, Me$_2$C*H*); 3.03 (*s*, Me–N(3)); 1.40 (*d*, *Me*$_2$CH). Anal. calc. for $C_8H_{13}N_3O_2$ (183.2): C 52.45, H 7.15, N 22.93; found: C 52.74, H 8.05, N 22.93.

*6-Amino-1-neopentylpyrimidine-2,4(1*H,*3*H*)-dione* (**14**). Neopentylurea (13.0 g, 0.1 mol) was dissolved in 4N NaOEt soln. (100 ml) and heated under reflux. Then 2-cyanoacetic acid methyl ester (10 ml) was added dropwise, and the mixture was heated for 4 h. After evaporation, the residue was dissolved in hot H_2O (100 ml) and the soln. acidified with AcOH to pH 5. The precipitate resulting on cooling was collected and dried: 11.2 g (59%) of **14**. Colorless crystals. M.p. 267°. UV (MeOH): 203 (4.02), 268 (4.32). ^{1}H-NMR ((D$_6$)DMSO): 10.29 (*s*, NH); 6.75 (*s*, NH$_2$); 4.51 (*s*, H–C(5)); 3.67 (*s*, CH$_2$); 0.89 (*s*, Me$_3$C). Anal. calc. for $C_9H_{15}N_3O_2$ (197.2): C 54.81, H 7.67, N 21.30; found: C 54.25, H 7.81, N 21.07.

*6-Amino-3-methyl-1-neopentylpyrimidine-2,4(1*H,*3*H*)-dione* (**15**) [32]. A soln. of **14** (5.0 g, 0.025 mol) in 1N NaOH (50 ml) was treated at 35° dropwise with dimethyl sulfate (3.5 g, 0.035 mol). During stirring for 1 h, a precipitate separated, which was filtered off and dried at 100°: 4.7 g (88%) of **15**. Colorless crystals. M.p. 229°. UV (MeOH): 203 (4.13), 268 (4.30). ^{1}H-NMR ((D$_6$)DMSO): 6.77 (*s*, NH$_2$); 4.66 (*s*, H–C(5)); 3.73 (br. *s*, CH$_2$); 3.06 (*s*, Me–N(3)); 0.89 (*s*, Me$_3$C). Anal. calc. for $C_{10}H_{17}N_3O_2$ (211.3): C 56.85, H 8.11, N 19.89; found: C 56.70, H 8.55, N 19.91.

*6-Amino-1-neopentyl-3-octylpyrimidine-2,4(1*H,*3*H*)-dione* (**16**). To a soln. of **14** (10.0 g, 0.051 mol) in DMF (200 ml) was added K_2CO_3 (20 g) and 1-bromooctane (12 g, 0.0625 mol). Then the mixture was heated in an oil bath to 70° with stirring. After 3 h and cooling, the insoluble solid was filtered off and discarded. The filtrate was evaporated and the residue purified by CC ($CHCl_3$). The main fraction was evaporated and the residue dried in a desiccator over P_4O_{10}: 11.2 g (72%) of **16**. Colorless solid. M.p. 105°. UV (MeOH): 203 (4.12), 269 (4.27). ^{1}H-NMR ((D$_6$)DMSO): 6.77 (*s*, NH$_2$); 4.63 (*s*, H–C(5)); 3.68 (*m*, CH$_2$–N(1), CH$_2$–N(3); 1.43 (*m*, C*H*$_2$CH$_2$–N(3)); 1.21 (*m*, 5 CH$_2$); 0.88 (*s*, Me$_3$C); 0.84 (*t*, *Me*(CH$_2$)$_7$). Anal. calc. for $C_{17}H_{31}N_3O_2$ (309.3): C 66.00, H 10.00, N 13.37; found: C 65.85, H 10.06, N 13.55.

*6-Amino-1-isopropyl-5-nitrosopyrimidine-2,4(1*H,*3*H*)-dione* (**17**). To a soln. of **12** (16.9 g, 0.1 mol) in EtOH/H_2O 1:1 (500 ml) was added $NaNO_2$ (10 g) and then dropwise with stirring AcOH (20 ml) at r.t. After 3 h, the red precipitate was collected and dried at 100°: 18.0 g (91%) of **17**. M.p. 230°. UV (MeOH): 227 (4.26), 317 (4.32). ^{1}H-NMR ((D$_6$)DMSO): 13.93 (br. *s*, 1 H, NH$_2$–C(6)); 11.39 (*s*, H–N(3)); 9.12 (br. *s*, 1 H, NH$_2$–C(6)); 4.50 (*m*, Me$_2$C*H*); 1.40 (*d*, *Me*$_2$CH). Anal. calc. for $C_7H_{10}N_4O_3$ (198.2): C 42.40, H 5.10, N 28.30; found: C 42.64, H 5.01, N 28.12.

*6-Amino-1-isopropyl-3-methyl-5-nitrosopyrimidine-2,4(1*H,*3*H*)-dione* (**18**) [32]. To a soln. of **13** (18.3 g, 0.1 mol) in H_2O (100 ml) was added at 50° $NaNO_2$ (6.9 g, 0.1 mol), and under stirring dropwise AcOH (20 ml). After cooling to r.t. and stirring for 1 h, the red precipitate was collected and dried at 100°: 17.1 g (80%) of **18**. M.p. 249°. UV (MeOH): 227 (4.20), 317 (4.29). ^{1}H-NMR ((D$_6$)DMSO): 13.78 (br. *s*, 1 H, NH$_2$–C(6)); 9.13 (br. *s*, 1 H, NH$_2$–C(6)); 4.55 (*m*, Me$_2$C*H*); 3.35 (*s*, MeN); 1.40 (*d*, *Me*$_2$CH). Anal. calc. for $C_8H_{12}N_4O_3$ (212.2): C 45.28, H 5.69, N 26.41; found: C 45.73, H 5.75, N 26.26.

*6-Amino-3-methyl-1-neopentyl-5-nitrosopyrimidine-2,4(1*H,*3*H*)-dione* (**19**). As described for **18** with **15** (10.05 g, 0.05 mol): 9.8 g (86%) of **19**. Dark red crystal. M.p. 212°. UV (MeOH): 227 (4.18), 317 (4.14). ^{1}H-NMR ((D$_6$)DMSO): 13.59 (br. *s*, 1 H, NH$_2$–C(6)); 9.05 (br. *s*, 1 H, NH$_2$–C(6)); 3.81 (*s*, CH$_2$); 3.27 (*s*, Me–N(3)); 0.89 (*s*, Me$_3$C). Anal. calc. for $C_{10}H_{16}N_4O_3$ (240.3): C 49.99, H 6.71, N 23.32; found: C 50.25, H 6.75, N 23.31.

*6-Amino-1-neopentyl-5-nitroso-3-octylpyrimidine-2,4(1*H,*3*H*)-dione* (**20**). As described for **18**, with **16** (15.45 g, 0.05 mol) in H_2O/EtOH 1:1 (200 ml): 11.8 g (70%) of **20**. Dark red crystals. M.p. 162°. UV (MeOH): 228 (4.16), 317 (4.11). ^{1}H-NMR ((D$_6$)DMSO): 13.54 (br. *s*, 1 H, NH$_2$–C(6)); 9.05 (br. *s*, 1 H,

NH_2–C(6)); 3.88 (*m*, CH_2–N(1), CH_2–N(3)); 1.57 (*m*, CH_2CH_2–N(3)); 1.26 (*m*, 5 CH_2); 0.88 (*s*, Me_3C); 0.84 (*t*, *Me*$(CH_2)_7$). Anal. calc. for $C_{17}H_{30}N_4O_3$ (338.3): C 60.32, H 8.94, N 16.55; found: C 60.45, H 9.09, N 16.43.

2-[(6-Amino-1,2,3,4-tetrahydro-2,4-dioxopyrimidin-5-yl)imino]acetic Acid Ethyl Esters **21**–**24**: *General Procedure 1* (*G.P. 1*). The appropriate 6-amino-5-nitrosopyrimidine-2,4(1*H*,3*H*)-dione **17**–**20** (0.02 mol) was treated with 20% aq. $(NH_4)_2S$ soln. (50 ml) at 70° till the red color had disappeared. Then the mixture was concentrated to half of the volume and the precipitate collected, washed with CS_2 to remove some sulfur, and dried in a desiccator. Part of the obtained corresponding 5,6-diaminopyrimidine-2,4(1*H*,3*H*)-dione (0.01 mol) was suspended in H_2O (80 ml) and treated with ethyl glyoxylate ethyl hemiacetal (1.8 g, 0.012 mol) at 50°. After stirring for 1.5 h at r.t., the precipitate was collected and dried at 100°.

2-[(6-Amino-1,2,3,4-tetrahydro-1-isopropyl-2,4-dioxopyrimidin-5-yl)imino]acetic Acid Ethyl Ester (**21**). According to the *G.P. 1* with 5,6-diamino-1-isopropylpyrimidine-2,4(1*H*,3*H*)-dione (1.84 g): 2.22 g (83%) of **21**. Pale yellow crystal powder. M.p. 224°. UV (MeOH): 277 (4.11), 352 (4.42). ^{1}H-NMR ((D_6)DMSO): 10.87 (*s*, H–N(3)); 8.87 (*s*, C*H*COOEt); 7.54 (br. *s*, NH_2); 4.59 (*m*, Me_2CH); 4.19 (*q*, $MeCH_2$); 1.44 (*d*, Me_2CH); 1.25 (*t*, *Me*CH_2). Anal. calc. for $C_{11}H_{16}N_4O_4$ (268.2): C 49.20, H 6.00, N 20.90; found: C 49.18, H 5.75, N 20.90.

2-[(6-Amino-1,2,3,4-tetrahydro-1-isopropyl-3-methyl-2,4-dioxopyrimidin-5-yl)imino]acetic Acid Ethyl Ester (**22**). According to the *G.P. 1*, with 5,6-diamino-1-isopropyl-3-methylpyrimidine-2,4(1*H*,3*H*)-dione (1.98 g): 2.68 g (95%) of **22**. Pale yellow crystal powder. M.p. 204°. UV (MeOH): 278 (4.05), 352 (4.37). ^{1}H-NMR ((D_6)DMSO): 8.88 (*s*, C*H*COOEt); 7.56 (br. *s*, NH_2); 4.63 (*m*, Me_2CH); 4.20 (*q*, $MeCH_2$); 3.10 (*s*, Me–N(3)); 1.46 (*d*, Me_2CH); 1.26 (*t*, *Me*CH_2). Anal. calc. for $C_{12}H_{18}N_4O_4 \cdot H_2O$ (290.3): C 49.64, H 6.94, N 19.30; found: C 49.14, H 6.82, N 19.08.

2-[(6-Amino-1,2,3,4-tetrahydro-3-methyl-1-neopentyl-2,4-dioxopyrimidin-5-yl)imino]acetic Acid Ethyl Ester (**23**). According to the *G.P. 1* with 5,6-diamino-3-methyl-1-neopentylpyrimidine-2,4(1*H*,3*H*)-dione (2.26 g): 2.79 g (90%) of **23**. Pale yellow crystal powder. M.p. 203°. UV (MeOH): 205 (4.10), 277 (4.08), 352 (4.31). ^{1}H-NMR ((D_6)DMSO): 8.90 (*s*, C*H*COOEt); 7.59 (br. *s*, NH_2); 4.20 (*q*, $MeCH_2$); 3.91 (*s*, CH_2); 3.14 (*s*, Me–N(3)); 1.27 (*t*, *Me*CH_2); 0.92 (*s*, Me_3C). Anal. calc. for $C_{14}H_{22}N_4O_4$ (310.35): C 54.18, H 7.15, N 18.07; found: C 54.17, H 7.57, N 18.10.

2-[(6-Amino-1,2,3,4-tetrahydro-1-neopentyl-3-octyl-2,4-dioxopyrimidin-5-yl)imino]acetic Acid Ethyl Ester (**24**). The nitroso derivative **20** (6.76 g, 0.02 mol) in EtOH (200 ml) was reduced catalytically with PtO_2 in a shaking apparatus under H_2. After uptake of 900 ml of H_2, the catalyst was filtered off, and ethyl glyoxylate ethyl hemiacetal (10 g) was added to the filtrate. After stirring overnight, the solvent was evaporated, the residue dissolved in AcOEt (20 ml), and hexane (50 ml) added to achieve crystallization. After cooling in the icebox, the precipitate was collected and dried at 80°: 6.28 g (77%) of **24**. Pale yellow crystal powder. M.p. 174°. UV (MeOH): 206 (4.11), 278 (4.07), 352 (4.29). ^{1}H-NMR ((D_6)DMSO): 8.90 (*s*, C*H*COOEt); 7.60 (br. *s*, NH_2); 4.21 (*q*, $MeCH_2$); 3.92 (*s*, CH_2–N(1)); 3.76 (*t*, CH_2–N(3)); 1.48 (*m*, CH_2CH_2–N(3)); 1.28 (*t*, *Me*CH_2); 1.24 (*m*, 5 CH_2); 0.91 (*s*, Me_3C); 0.84 (*t*, *Me*$(CH_2)_7$). Anal. calc. for $C_{21}H_{36}N_4O_4$ (408.5): C 61.20, H 8.80, N 13.60; found: C 61.35, H 8.82, N 13.60.

2-[(6-Amino-1,2,3,4-tetrahydro-2,4-dioxo-1,3-dipropylpyrimidin-5-yl)imino]acetic Acid Methyl Ester (**25**). A suspension of 5,6-diamino-1,3-dipropylpyrimidine-2,4(1*H*,3*H*)-dione [33] (11.3 g, 0.05 mol) in H_2O (100 ml) and EtOH (50 ml) was treated under stirring with methyl glyoxalate ethyl hemiacetal (12.0 g, 0.8 mol). The mixture was heated to 50° for 1 h, and then the precipitate was filtered off and dried at 60°: 13.5 g (87%) of **25**. Yellowish crystal powder which was recrystallized from EtOH. M.p. 177–178°. UV (MeOH): 204 (4.00), 233 (4.08), 275 (4.03), 353 (4.26). ^{1}H-NMR ((D_6)DMSO): 8.19 (*s*, C*H*COOMe); 7.60 (br. *s*, NH_2); 4.19 (*t*, CH_2–N(1)); 3.91 (*t*, CH_2–N(3)); 3.76 (*s*, MeO); 1.55 (*m*, 2 CH_2CH_2N); 0.92 (*m*, 2 *Me*CH_2CH_2N). Anal. calc. for $C_{13}H_{20}N_4O_4$ (296.4): C 52.68, H 6.80, N 18.91; found: C 52.88, H 6.78, N 18.97.

*1-Monosubstituted and 1,3-Disubstituted 7-Hydroxypteridine-2,4(1*H*,3*H*)-diones* **26**–**35**: *General Procedure 2* (*G.P. 2*). The appropriate [(6-amino-1,2,3,4-tetrahydro-2,4-dioxopyrimidin-5-yl)imino]acetic acid ester **21**–**25** (0.01 mol) was heated under reflux in 1N $NaHCO_3$ (40 ml) and EtOH (10 ml) for 1 h. The mixture was carefully acidified with HCl to pH 0, and after cooling, the precipitate was collected and dried at 100°.

*7-Hydroxy-1-isopropylpteridine-2,4(1*H,*3*H*)-dione* (**28**). According to the *G.P. 2*, with **21** (2.68 g): 2.18 g (91%) of **28**. Colorless crystal powder. M.p. 270°. UV (MeOH): 206 (4.33), 264 (3.93), 325 (4.24). ^{1}H-NMR ((D$_6$)DMSO): 13.02 (br. *s*, OH); 11.55 (*s*, H–N(3)); 7.96 (*s*, H–C(6)); 5.51 (*m*, Me$_2$C*H*); 1.46 (*d*, *Me*$_2$CH). Anal. calc. for $C_9H_{10}N_4O_3 \cdot H_2O$ (240.2): C 45.00, H 5.04, N 23.33; found: C 45.50, H 5.25, N 23.43.

*7-Hydroxy-1-isopropyl-3-methylpteridine-2,4(1*H,*3*H*)-dione* (**29**). According to the *G.P. 2*, with **22** (2.90 g): 2.15 g (91%) of **29**. Colorless crystal powder. M.p. 245°. UV (MeOH): 209 (4.32), 264 (3.88), 325 (4.25). ^{1}H-NMR ((D$_6$)DMSO): 13.07 (br. *s*, OH); 8.00 (*s*, H–C(6)); 5.47 (*m*, Me$_2$C*H*); 3.29 (*s*, Me–N(3)); 1.48 (*d*, *Me*$_2$CH). Anal. calc. for $C_{10}H_{12}N_4O_3$ (236.2): C 50.85, H 5.11, N 23.72; found: C 51.13, H 5.46, N 23.90.

*7-Hydroxy-3-methyl-1-neopentylpteridine-2,4(1*H,*3*H*)-dione* (**30**). According to the *G.P. 2*, with **23** (3.10 g): 2.11 g (80%) of **30**. Colorless crystal powder. M.p. 300°. UV (MeOH): 208 (4.37), 265 (3.84), 326 (4.12). ^{1}H-NMR ((D$_6$)DMSO): 12.97 (br. *s*, OH); 7.99 (*s*, H–C(6)); 4.06 (*s*, CH$_2$); 3.28 (*s*, Me–N(3)); 0.92 (*s*, Me$_3$C). Anal. calc. for $C_{12}H_{16}N_4O_3$ (264.3): C 54.54, H 6.10, N 21.20; found: C 54.52, H 6.53, N 21.27.

*7-Hydroxy-1-neopentyl-3-octylpteridine-2,4(1*H,*3*H*)-dione* (**31**). According to the *G.P. 2*, with **24** (4.1 g): 3.27 g (86%) of **31**. Colorless crystal powder. M.p. 255°. UV (MeOH): 211 (4.36), 265 (3.85), 327 (4.14). ^{1}H-NMR ((D$_6$)DMSO): 13.05 (br. *s*, OH); 8.00 (*s*, H–C(6)); 4.07 (*s*, CH$_2$–N(1)); 3.90 (*m*, CH$_2$–N(3)); 1.55 (*t*, C*H*$_2$CH$_2$–N(3)); 1.24 (*m*, 5 CH$_2$); 0.90 (*s*, Me$_3$C); 0.83 (*t*, *Me*(CH$_2$)$_7$). Anal. calc. for $C_{19}H_{30}N_4O_3 \cdot H_2O$ (380.5): C 60.00, H 8.40, N 14.74; found: C 60.40, H 8.13, N 14.88.

*7-Hydroxy-1,3-dipropylpteridine-2,4(1*H,*3*H*)-dione* (**32**). According to the *G.P. 2*, with **25** (2.96 g): 2.0 g (76%) of **32**. Colorless crystals. M.p. 238°. UV (MeOH): 210 (4.45), 270 (4.04), 326 (4.22). ^{1}H-NMR ((D$_6$)DMSO): 13.16 (br. *s*, OH); 8.00 (*s*, H–C(6)); 4.06 (*t*, CH$_2$–N(1)); 3.86 (*t*, CH$_2$–N(3)); 1.60 (*m*, C*H*$_2$CH$_2$–N(1), C*H*$_2$CH$_2$–N(3)); 0.90 (*m*, 2 *Me*CH$_2$CH$_2$N). Anal. calc. for $C_{12}H_{16}N_4O_3$ (264.3): C 54.53, H 6.10, N 21.20; found: C 54.65, H 6.07, N 21.11.

*7-Chloropteridine-2,4(1*H,*3*H*)-diones* **36**–**45**: *General Procedure 3* (*G.P. 3*). Treatment of the appropriate 7-hydroxypteridine-2,4(1*H*,*3H*)-dione **26**–**35** (0.04 mol) in POCl$_3$ (200 ml) in presence of KCl (10 g) for 5 h at 90–95° gave a clear soln. The POCl$_3$ was evaporated and the residue treated with ice (200 g) to give a colorless crystal powder which was washed with H$_2$O and dried in a vacuum desiccator over P$_4$O$_{10}$. The substances are chromatographically pure. Samples for elemental analysis were recrystallized from H$_2$O, EtOH, or H$_2$O/EtOH.

*7-Chloro-1,3-dimethylpteridine-2,4(1*H,*3*H*)-dione* (**36**) [34]. According to the *G.P. 3*, with 7-hydroxy-1,3-dimethylpteridine-2,4(1*H*,*3H*)-dione · H$_2$O (**26**) [35] (9.04 g): 8.23 g (91%) of **36**. M.p. 185°. ([34]: 184°). UV (MeOH): 205 (4.15), 240 (4.14), 335 (3.99). ^{1}H-NMR ((D$_6$)DMSO): 8.68 (*s*, H–C(6)); 3.49 (*s*, Me–N(1)); 3.32 (*s*, Me–N(3)).

*7-Chloro-1-methylpteridine-2,4(1*H,*3*H*)-dione* (**37**) [36]. According to the *G.P. 3*, with 7-hydroxy-1-methylpteridine-2,4(1*H*,*3H*)-dione · H$_2$O (**27**) [37] (8.48 g): 7.2 g (85%) of **37**. M.p. 285°. ([36]: 284–286°). UV (MeOH): 203 (4.30), 237 (4.08), 335 (3.99). ^{1}H-NMR ((D$_6$)DMSO): 12.07 (*s*, NH); 8.63 (*s*, H–C(6)); 3.40 (*s*, Me–N(1)). Anal. calc. for $C_7H_5ClN_4O_2$ (212.6): C 39.54, H 2.37, N 26.36; found: C 39.59, H 2.25, N 26.18.

*7-Chloro-1-isopropylpteridine-2,4(1*H,*3*H*)-dione* (**38**). According to the *G.P. 3*, with **28** (9.6 g): 7.49 g (78%) of **38**. M.p. 226°. UV (MeOH): 237 (4.09), 336 (4.13). ^{1}H-NMR ((D$_6$)DMSO): 11.95 (*s*, NH); 8.62 (*s*, H–C(6)); 5.30 (*m*, Me$_2$C*H*); 1.47 (*d*, *Me*$_2$CH). Anal. calc. for $C_9H_9ClN_4O_2$ (240.6): C 44.92, H 3.77, N 23.29; found: C 44.96, H 3.64, N 23.01.

*7-Chloro-1-isopropyl-3-methylpteridine-2,4(1*H,*3*H*)-dione* (**39**). According to the *G.P. 3*, with **29** (9.44 g): 8.15 g (80%) of **39**. M.p. 181°. UV (MeOH): 243 (4.16), 335 (4.10). ^{1}H-NMR ((D$_6$)DMSO): 8.67 (*s*, H–C(6)); 5.39 (*m*, Me$_2$C*H*); 3.30 (*s*, Me–N(3)); 1.49 (*d*, *Me*$_2$CH). Anal. calc. for $C_{10}H_{11}ClN_4O_2$ (254.6): C 47.16, H 4.35, N 22.00; found: C 47.46, H 4.63, N 22.31.

*7-Chloro-3-methyl-1-neopentylpteridine-2,4(1*H,*3*H*)-dione* (**40**). According to the *G.P. 3*, with **30** (10.56 g): 8.03 g (71%) of **40**. M.p. 166°. UV (MeOH): 205 (4.22), 240 (4.17), 335 (3.96). ^{1}H-NMR ((D$_6$)DMSO): 8.67 (*s*, H–C(6)); 4.07 (*s*, CH$_2$–N(1)); 3.32 (*s*, Me–N(3)); 0.93 (*s*, Me$_3$C). Anal. calc. for $C_{12}H_{15}ClN_4O_2$ (282.7): C 50.98, H 5.35, N 19.81; found: C 50.86, H 5.64, N 19.85.

*7-Chloro-1-neopentyl-1-octylpteridine-2,4(1*H,*3*H*)-dione* (**41**). According to the *G.P. 3*, with **31** (15.22 g): 13.0 g (86%) of **41**. M.p. 85°. UV (MeOH): 205 (4.26), 245 (4.17), 335 (3.97). ^{1}H-NMR ($CDCl_3$): 8.45 (*s*, H–C(6)); 4.21 (*s*, CH_2–N(1)); 4.08 (*t*, CH_2–N(3)); 1.30 (*m*, CH_2CH_2–N(3)); 1.23 (*m*, 5 CH_2); 0.94 (*s*, Me_3C); 0.85 (*t*, *Me*$(CH_2)_7$). ^{1}H-NMR ((D_6)DMSO): 8.66 (*s*, H–C(6)); 4.07 (*s*, CH_2–N(1)); 3.94 (*t*, CH_2–N(3)); 1.58 (*t*, CH_2CH_2–N(3)); 1.27 (*m*, 5 CH_2); 0.92 (*s*, Me_3C); 0.85 (*t*, *Me*$(CH_2)_7$). Anal. calc. for $C_{19}H_{29}ClN_4O_2$ (380.7): C 59.88, H 7.62, N 14.70; found: C 60.08, H 7.85, N 14.77.

*7-Chloro-1,3-dipropylpteridine-2,4(1*H,*3*H*)-dione* (**42**). According to the *G.P. 3*, with **35** (10.56 g): 8.14 g (72%) of **42**. M.p. 116°. UV (MeOH): 205 (4.08), 243 (4.07), 336 (3.92). ^{1}H-NMR ($CDCl_3$): 8.50 (*s*, H–C(6)); 4.24 (*s*, CH_2–N(1)); 4.08 (*t*, CH_2–N(3)); 1.75 (*m*, CH_2CH_2–N(1), CH_2CH_2–N(3)); 0.98 (*m*, 2 *Me*CH_2CH_2N). Anal. calc. for $C_{12}H_{15}ClN_4O_2$ (282.7): C 50.98, H 5.35, N 19.82; found: C 50.94, H 5.32, N 19.80.

*7-Chloro-3-methylpteridine-2,4(1*H,*3*H*)-dione* (**43**) [36]. According to the *G.P. 3*, with 7-hydroxy-3-methylpteridine-2,4(1*H*,*3H*)-dione · H_2O (**33**) [37] (8.48 g): 7.23 g (85%) of **43**. M.p. 306–308° ([36]: 308–310°). UV (MeOH): 202 (4.24), 236 (4.12), 333 (4.00). ^{1}H-NMR ((D_6)DMSO): 12.48 (*s*, NH); 8.61 (*s*, H–C(6)); 3.25 (*s*, MeN).

*7-Chloro-1,3,6-trimethylpteridine-2,4(1*H,*3*H*)-dione* (**44**) [36]. According to the *G.P. 3*, with 7-hydroxy-1,3,6-trimethylpteridine-2,4(1*H*,*3H*)-dione (**34**) [38] (8.88 g): 8.83 g (92%) of **44**. M.p. 160°. ([36]: 161°). UV (MeOH): 202 (4.25), 242 (4.21), 340 (4.01). ^{1}H-NMR ($CDCl_3$): 3.65 (*s*, Me–N(1)); 3.50 (*s*, Me–N(3)); 2.74 (*s*, Me–C(6)).

*7-Chloro-6-isopropyl-1,3-dimethylpteridine-2,4(1*H,*3*H*)-dione* (**45**). According to the *G.P. 3*, with 7-hydroxy-6-isopropyl-1,3-dimethylpteridine-2,4(1*H*,*3H*)-dione (**35**) [39] (10.0 g): 9.0 g (84%) of **45** which was recrystallized from MeOH. M.p. 147°. UV (MeOH): 203 (4.23), 243 (4.23), 340 (4.01). ^{1}H-NMR ((D_6)DMSO): 3.51 (*m*, Me_2CH); 3.47 (*s*, Me–N(1)); 3.31 (*s*, Me–N(3)); 1.27 (*d*, *Me*$_2$CH). Anal. calc. for $C_{11}H_{13}ClN_4O_2$ (269.7): C 48.98, H 4.86, N 20.78; found: C 49.17, H 4.83, N 20.93.

*7-Hydrazinylpteridine-2,4(1*H,*3*H*)-diones* **46**–**55**: *General Procedure 4* (*G.P. 4*). A suspension of the appropriate 7-chloropteridine-2,4(1*H*,*3H*)-dione **36**–**45** (10 mmol) in EtOH (100 ml) was treated with hydrazine hydrate (10 ml) by gentle warming to 50° to give a clear soln. from which, after a few minutes, a yellowish precipitate separated out. After cooling to r.t. and stirring for 30 min, the solid was collected and recrystallized from H_2O or H_2O/EtOH.

*7-Hydrazinyl-1,3-dimethylpteridine-2,4(1*H,*3*H*)-dione* (**46**) [40]. According to the *G.P. 4*, with **36** (2.26 g): 1.70 g (77%) of **46** which was recrystallized from DMF. Yellowish needles. M.p. 270° ([40]: 271°). UV (MeOH): 218 (4.28), 282 (3.87), 343 (4.05). ^{1}H-NMR ((D_6)DMSO): 9.20 (*s*, N*H*NH_2); 7.95 (*s*, H–C(6)); 4.73 (br. *s*, NHN*H*$_2$); 3.45 (*s*, Me–N(1)); 3.24 (*s*, Me–N(3)).

*7-Hydrazinyl-1-methylpteridine-2,4(1*H,*3*H*)-dione* (**47**). According to the *G.P. 4*, with **37** (2.13 g): 1.70 g (77%) of **47**. Yellowish needles. M.p. 270°. UV (MeOH): 218 (4.28), 282 (3.87), 343 (4.05). ^{1}H-NMR ((D_6)DMSO): 11.30 (*s*, NH); 9.40 (br. *s*, N*H*NH_2); 7.95 (br. *s*, H–C(6)); 4.75 (*s*, NHN*H*$_2$); 3.38 (*s*, MeN). Anal. calc. for $C_7H_8N_6O_2$ (208.2): C 40.38, H 3.87, N 40.37; found: C 40.08, H 4.09, N 40.17.

*7-Hydrazinyl-1-isopropylpteridine-2,4(1*H,*3*H*)-dione* (**48**). According to the *G.P. 4*, with **38** (2.4 g): 1.87 g (79%) of **48**. Yellowish needles. M.p. 292°. UV (MeOH): 219 (4.40), 281 (4.01), 342 (4.15). ^{1}H-NMR ((D_6)DMSO, 80°): 10.86 (*s*, NH); 9.11 (*s*, N*H*NH_2); 7.92 (br. *s*, H–C(6)); 5.44 (*s*, Me_2CH); 4.61 (br. *s*, NHN*H*$_2$); 1.49 (*d*, *Me*$_2$CH). Anal. calc. for $C_9H_{12}N_6O_2 \cdot H_2O$ (254.2): C 42.51, H 5.55, N 33.06; found: C 42.83, H 5.39, N 33.02.

*7-Hydrazinyl-1-isopropyl-3-methylpteridine-2,4(1*H,*3*H*)-dione* (**49**). According to the *G.P. 4*, with **39** (2.54 g): 1.78 g (71%) of **49**. Yellowish needles. M.p. 256–258°. UV (MeOH): 220 (4.35), 281 (3.98), 341 (4.15). ^{1}H-NMR ((D_6)DMSO): 9.42 (*s*, N*H*NH_2); 8.00 (br. *s*, H–C(6)); 5.58 (*s*, Me_2CH); 4.84 (br. *s*, NHN*H*$_2$); 3.23 (*s*, MeN); 1.47 (*d*, *Me*$_2$CH). Anal. calc. for $C_{10}H_{14}N_6O_2$ (250.3): C 47.98, H 5.64, N 33.58; found: C 47.92, H 5.52, N 33.55.

*7-Hydrazinyl-3-methyl-1-neopentylpteridine-2,4(1*H,*3*H*)-dione* (**50**). According to the *G.P. 4*, with **40** (2.83 g): 2.6 g (69%) of **50**. Yellowish needles. M.p. 296°. UV (MeOH): 220 (4.32), 280 (3.97), 342 (4.14). ^{1}H-NMR ((D_6)DMSO): 9.20 (br. *s*, N*H*NH_2); 7.94 (br. *s*, H–C(6)); 4.71 (*s*, CH_2–N(1)); 4.09 (br. *s*, NHN*H*$_2$); 3.25 (*s*, CH_2–N(3)); 0.91 (*s*, Me_3C). Anal. calc. for $C_{12}H_{18}N_6O_2$ (278.3): C 51.78, H 6.52, N 30.20; found: C 51.68, H 6.57, N 29.91.

*7-Hydrazinyl-1-neopentyl-3-octylpteridine-2,4(1*H,*3*H*)-dione* (**51**). According to the *G.P. 4*, with **41** (3.8 g): 1.8 g (65%) of **51**. Yellowish needles. M.p. 238°. UV (MeOH): 221 (4.38), 282 (4.01), 343 (4.24). ^{1}H-NMR ((D$_6$)DMSO): 9.38 (br. *s*, N*H*NH$_2$); 7.96 (br. *s*, H–C(6)); 4.73 (*s*, CH$_2$–N(1)); 4.09 (br. *s*, NHN*H*$_2$); 3.87 (*t*, CH$_2$–N(3)); 1.53 (*m*, C*H*$_2$CH$_2$–N(3)); 1.24 (*m*, 5 CH$_2$); 0.90 (*s*, Me$_3$C); 0.83 (*t*, *Me*(CH$_2$)$_7$). Anal. calc. for C$_{19}$H$_{32}$N$_6$O$_2$ (377.5): C 60.45, H 8.54, N 22.26; found: C 60.67, H 8.54, N 22.48.

*7-Hydrazinyl-1,3-dipropylpteridine-2,4(1*H,*3*H*)-dione* (**52**). According to the *G.P. 4*, with **42** (2.83 g): 1.85 g (67%) of **52**. Yellowish needles. M.p. 270°. UV (MeOH): 220 (4.38), 281 (4.01), 342 (4.19). ^{1}H-NMR ((D$_6$)DMSO): 8.22 (br. *s*, N*H*NH$_2$); 7.56 (*s*, H–C(6)); 4.75 (br. *s*, NHN*H*$_2$); 4.10 (*m*, CH$_2$–N(1)); 3.84 (*m*, CH$_2$–N(3)); 1.58 (*m*, 2 C*H*$_2$CH$_2$N); 0.86 (*m*, 2 *Me*CH$_2$CH$_2$N). Anal. calc. for C$_{12}$H$_{18}$N$_6$O$_2$ (276.3): C 52.16, H 6.57, N 30.42; found: C 52.23, H 6.57, N 30.39.

*7-Hydrazinyl-3-methylpteridine-2,4(1*H,*3*H*)-dione* (**53**). According to the *G.P. 4*, with **43** (2.13 g, 10 mmol): 1.90 g (91%) of **53** which was recrystallized from H$_2$O. Yellowish needles. M.p. >300°. UV (MeOH): 215 (4.41), 279 (4.01), 340 (4.15). ^{1}H-NMR ((D$_6$)DMSO): 11.57 (*s*, NH); 9.31 (*s*, N*H*NH$_2$); 7.86 (*s*, H–C(6)); 4.66 (br. *s*, NHN*H*$_2$); 3.18 (*s*, MeN). Anal. calc. for C$_7$H$_8$N$_6$O$_2$ (208.2): C 40.38, H 3.87, N 40.37; found: C 40.13, H 4.01, N 39.84

*7-Hydrazinyl-1,3,6-trimethylpteridine-2,4(1*H,*3*H*)-dione* (**54**) [40]. According to the *G.P. 4*, with **44** (2.4 g, 10 mmol): 1.90 g (81%) of **54** which was recrystallized from H$_2$O. Yellowish needles. M.p. 276°. UV (MeOH): 217 (4.36), 281 (3.93), 339 (4.19). ^{1}H-NMR ((D$_6$)DMSO): 9.25 (*s*, N*H*NH$_2$); 4.84 (*s*, NHN*H*$_2$); 3.34 (*s*, Me–N(3)); 3.25 (*s*, Me–N(1)); 2.29 (*s*, Me–C(6)).

*7-Hydrazinyl-6-isopropyl-1,3-dimethylpteridine-2,4(1*H,*3*H*)-dione* (**55**). According to the *G.P. 4*, with **45** (2.7 g, 10 mmol): 1.98 g (75%) of **55** which was recrystallized from H$_2$O. Yellowish needles. M.p. 269°. UV (MeOH): 216 (4.29), 281 (3.86), 338 (4.14). ^{1}H-NMR ((D$_6$)DMSO): 9.21 (*s*, N*H*NH$_2$); 4.86 (*s*, NHN*H*$_2$); 3.52 (*s*, Me–N(1)); 3.25 (*s*, Me–N(3)); 3.15 (*m*, Me$_2$C*H*); 1.14 (*d*, *Me*$_2$CH). Anal. calc. for C$_{11}$H$_{16}$N$_6$O$_2$ (264.3): C 49.99, H 6.10, N 31.80; found: C 49.88, H 6.05, N 31.76.

*7-Azidopteridine-2,4(1*H,*3*H*)-diones* **56**–**64**: *General Procedure 5* (*G.P. 5*). To a suspension of the appropriate 7-hydrazinylpteridine-2,4(1*H*,*3H*)-dione **46**–**55** (10 mmol) in H$_2$O (100 ml) was added NaNO$_2$ (0.8 g, 11.6 mmol) with stirring, and then dropwise conc. HCl soln. (2 ml). The solid was changing without the intermediate formation of a soln. and was filtered off after 30 min, washed with EtOH and Et$_2$O, and dried in a vacuum desiccator: slightly brownish crystal powder. Recrystallization was achieved from H$_2$O, EtOH, or DMF.

*7-Azido-1-methylpteridine-2,4(1*H,*3*H*)-dione* (**56**). According to the *G.P. 5*, with **47** (2.08 g): 1.75 g (80%) of **56**. Yellowish crystals. M.p. >320°. UV (MeOH): 212 (4.22), 250 (4.12), (262 (sh, 4.09), 344 (4.20). ^{1}H-NMR ((D$_6$)DMSO): 11.94 (*s*, H–N(3)); 8.20 (*s*, H–C(6)); 3.42 (*s*, Me–N(1)). Anal. calc. for C$_7$H$_5$N$_7$O$_2$ (219.2): C 38.35, H 2.30, N 44.73; found: C 38.39, H 2.45, N 44.07.

*7-Azido-1-isopropylpteridine-2,4(1*H,*3*H*)-dione* (**57**). According to the *G.P. 5*, with **48** (2.36 g): 1.44 g (58%) of **57**. Yellowish crystals. M.p. 216–218°. UV (MeOH): 217 (4.29), 253 (4.14), 264 (sh, 4.11), 349 (4.23). ^{1}H-NMR ((D$_6$)DMSO): 11.27 (*s*, H–N(3)); 8.30 (*s*, H–C(6)); 5.30 (*m*, Me$_2$C*H*); 1.45 (*s*, *Me*$_2$CH). Anal. calc. for C$_9$H$_9$N$_7$O$_2$ (247.2): C 43.73, H 3.67, N 39.66; found: C 43.95, H 3.69, N 39.36.

*7-Azido-1-isopropyl-3-methylpteridine-2,4(1*H,*3*H*)-dione* (**58**). According to the *G.P. 5*, with **49** (2.5 g): 2.1 g (80%) of **58**. Yellowish crystals. M.p. 146°. UV (MeOH): 216 (4.26), 250 (4.17), 266 (sh, 4.02), 357 (4.22). ^{1}H-NMR ((D$_6$)DMSO): 8.24 (*s*, H–C(6)); 5.43 (*m*, Me$_2$C*H*); 3.20 (*s*, Me–N(3)); 1.52 (*s*, *Me*$_2$CH). Anal. calc. for C$_{10}$H$_{11}$N$_7$O$_2$ (261.3): C 45.96, H 4.24, N 37.53; found: C 46.23, H 4.35, N 37.45.

*7-Azido-3-methyl-1-neopentylpteridine-2,4(1*H,*3*H*)-dione* (**59**). According to the *G.P. 5*, with **50** (2.78 g): 2.6 g (90%) of **59**. Yellowish crystals. M.p. 159°. UV (MeOH): 217 (4.23), 252 (4.15), 268 (sh, 3.99), 348 (4.20). ^{1}H-NMR ((D$_6$)DMSO): 8.24 (*s*, H–C(6)); 4.10 (*s*, CH$_2$–N(1)); 3.32 (*s*, Me–N(3)); 0.94 (*s*, Me$_3$C). Anal. calc. for C$_{12}$H$_{15}$N$_7$O$_2$ (289.3): C 49.82, H 5.23, N 33.89; found: C 49.94, H 5.20, N 33.57.

*7-Azido-1-neopentyl-3-octylpteridine-2,4(1*H,*3*H*)-dione* (**60**). According to the *G.P. 5*, with **51** (1.88 g, 0.05 mmol): 1.45 g (75%) of **60**. Yellowish crystals. M.p. 160°. UV (MeOH): 219 (4.26), 252 (4.06), 271 (sh, 3.94), 347 (4.20). ^{1}H-NMR ((D$_6$)DMSO): 8.23 (*s*, H–C(6)); 4.10 (*s*, CH$_2$–N(1)); 3.91 (*m*, CH$_2$–N(3)); 1.57 (*m*, C*H*$_2$CH$_2$–N(3)); 1.23 (*m*, 5 CH$_2$); 0.92 (*s*, Me$_3$C); 0.84 (*t*, *Me*(CH$_2$)$_7$). Anal. calc. for C$_{19}$H$_{29}$N$_7$O$_2$ (387.5): C 60.29, H 7.54, N 25.30; found: C 60.12, H 7.55, N 25.14.

*7-Azido-1,3-dipropylpteridine-2,4(1*H,*3*H*)-dione* (**61**). According to the *G.P. 5*, with **52** (2.76 g, 10 mmol): 1.97 g (68%) of **61**. Yellowish crystals. M.p. 104°. UV (MeOH): 216 (4.18), 251 (4.11), 268 (sh, 3.94), 348 (4.19). ^{1}H-NMR ((D$_6$)DMSO): 8.25 (*s*, H–C(6)); 4.10 (*t*, CH$_2$–N(1)); 3.90 (*t*, CH$_2$–N(3)); 1.68 (*m*, 2 C*H*$_2$CH$_2$N); 0.91 (*m*, 2 *Me*CH$_2$CH$_2$N). Anal. calc. for $C_{12}H_{15}N_7O_2$ (289.3): C 49.82, H 5.23, N 33.89; found: C 49.80, H 5.37, N 33.68.

*7-Azido-3-methylpteridine-2,4(1*H,*3*H*)-dione* (**62**). According to the *G.P. 5*, with **53** (2.08 g): 1.8 g (86%) of **62**. M.p. >320°. UV (MeOH): 211 (4.27), 245 (4.06), 260 (sh, 3.90), 346 (4.22). ^{1}H-NMR ((D$_6$)DMSO): 12.31 (*s*, H–N(1)); 8.19 (*s*, H–C(6)); 3.24 (*s*, Me–N(3)). Anal. calc. for $C_7H_5N_7O_2$ (219.2): C 38.35, H 2.30, N 44.73; found: C 38.16, H 2.10, N 44.88.

*7-Azido-1,3,6-trimethylpteridine-2,4(1*H,*3*H*)-dione* (**63**). According to the *G.P. 5*, with **54** (2.47 g): 2.0 g (86%) of **63**. M.p. 143° (dec.). UV (MeOH): 214 (4.19), 251 (4.18), 264 (sh, 4.03), 354 (4.15). ^{1}H-NMR ((D$_6$)DMSO): 3.50 (*s*, Me–N(1)); 3.31 (*s*, Me–N(3)); 2.41 (*s*, Me–C(6)). Anal. calc. for $C_9H_9N_7O_2$ (247.2): C 43.73, H 3.67, N 39.67; found: C 43.59, H 3.82, N 39.57.

*7-Azido-6-isopropyl-1,3-dimethylpteridine-2,4(1*H,*3*H*)-dione* (**64**). According to the *G.P. 5*, with **55** (2.64 g): 2.41 g (87%) of **64**. M.p. 136° (dec.). UV (MeOH): 214 (4.23), 251 (4.22), 264 (sh, 4.05), 353 (4.18). ^{1}H-NMR ((D$_6$)DMSO): 3.50 (*s*, Me–N(1)); 3.30 (*s*, Me–N(3)); 3.24 (*m*, Me$_2$C*H*); 1.22 (*s*, *Me*$_2$CH). Anal. calc. for $C_{11}H_{13}N_7O_2$ (275.3): C 47.99, H 4.76, N 35.62; found: C 48.15, H 4.89, N 35.30.

2,3,6,7-Tetrahydro-3-methyl-N-*methylidyne-2,6-dioxo-1*H-*purin-3-aminium Inner Salt* (**65**). A soln. of **56** (0.219 g, 1 mmol) in xylene (6 ml) was heated under reflux for 20 min. After cooling, the precipitate was collected, washed with MeOH and Et$_2$O, and dried at 60°: 0.145 g (76%) of **65**. Yellowish crystal powder. M.p. >320°. UV (MeOH): 233 (4.17), 250 (sh, 3.98), 299 (4.20); pK_a 2.37. UV (pH 0): 231 (4.17), 289 (4.06), UV (pH 5): 231 (4.18), 260 (sh, 3.82), 306 (4.14). ^{1}H-NMR ((D$_6$)DMSO): 11.66 (*s*, NH); 8.35 (*s*, C*H*≡N$^+$); 3.28 (*s*, Me–N(3)). Anal. calc. for $C_7H_5N_5O_2 \cdot H_2O$ (209.2): C 40.20, H 3.37, N 33.49; found: C 40.10, H 3.62, N 33.47.

2,3,6,7-Tetrahydro-3-isopropyl-N-*methylidyne-2,6-dioxo-1*H-*purin-8-aminium Inner Salt* (**66**). As described for **65**, with **57** (0.247 g, 1 mmol) in xylene (5 ml) for 10 min: 0.145 g (66%) of **66**. Yellowish crystals. M.p. 207°. UV (MeOH): 235 (4.15), 254 (sh, 3.85), 302 (4.07). ^{1}H-NMR ((D$_6$)DMSO): 11.50 (*s*, NH); 8.41 (*s*, CH≡N$^+$); 5.30 (*q*, Me$_2$C*H*): 1.41 (*d*, *Me*$_2$CH). Anal. calc. for $C_9H_9N_5O_2$ (219.2): C 49.31, H 4.14, N 31.95; found: C 49.44, 4.08, N 31.75.

2,3,6,7-Tetrahydro-3-isopropyl-1-methyl-N-*methylidyne-2,6-dioxo-1*H-*purin-8-aminium Inner Salt* (**67**). A soln. of **58** (0.261 g, 1 mmol) in xylene (4 ml) was heated under reflux for 10 min. After cooling, little MeOH and Et$_2$O were added, and the precipitate was collected and dried: 0.15 g (64%) of **67**. Yellowish crystals. M.p. 176°. UV (MeOH): 237 (4.19), 250 (sh, 3.97), 296 (4.19). ^{1}H-NMR ((D$_6$)DMSO): 8.58 (*s*, CH≡N$^+$); 5.35 (*q*, Me$_2$C*H*): 3.43 (*s*, Me–N(1)); 1.42 (*d*, *Me*$_2$CH). Anal. calc. for $C_{10}H_{11}N_5O_2$ (233.2): C 51.49, H 4.75, N 30.03; found: C 51.38, H 5.07, N 29.97.

2,3,6,7-Tetrahydro-3-neopentyl-1-methyl-N-*methylidyne-2,6-dioxo-1*H-*purin-8-aminium Inner Salt* (**68**). As described for **67**, with **59** (0.289 g) in xylene (6 ml) for 15 min. Drying at 60° gave 0.18 g (69%) of **68**. M.p. 175°. UV (MeOH): 237 (4.19), 250 (sh, 3.98), 297 (4.19). ^{1}H-NMR ((D$_6$)DMSO): 8.60 (*s*, CH≡N$^+$); 3.99 (*s*, CH$_2$); 3.46 (*s*, Me–N(1)); 0.93 (*s*, Me$_3$C). Anal. calc. for $C_{12}H_{15}N_5O_2$ (261.3): C 55.15, H 5.79, N 26,80; found: C 54.95, H 5.63, N 26.58.

2,3,6,7-Tetrahydro-3-neopentyl-1-octyl-N-*methylidyne-2,6-dioxo-1*H-*purin-8-aminium Inner Salt* (**69**). A soln. of **60** (0.196 g, 0.5 mmol) in xylene (3 ml) was heated under reflux for 15 min. After cooling, hexane (3 ml) was added, and the resulting precipitate was collected and dried in a vacuum desiccator: 0.115 g (64%) of **69**. Yellowish crystals. M.p. 173°. UV (MeOH): 228 (4.22), 250 (sh, 3.98), 297 (4.25). ^{1}H-NMR ((D$_6$)DMSO): 8.58 (*s*, CH≡N$^+$); 3.98 (*s*, CH$_2$–N(3)); 3.95 (*t*, CH$_2$–N(1)); 1.68 (*t*, C*H*$_2$CH$_2$–N(1)); 1.24 (*m*, 5 CH$_2$); 0.92 (*s*, Me$_3$C); 0.85 (*t*, *Me*(CH$_2$)$_7$). Anal. calc. for $C_{19}H_{29}N_5O_2$ (359.5): C 63.48, H 8.13, N 19.48; found: C 63.45, H 8.10, N 19.41.

2,3,6,7-Tetrahydro-1,3-dipropyl-N-*methylidyne-2,6-dioxo-1*H-*purin-8-aminium Inner Salt* (**70**). A soln. of **61** (0.5 g, 1.73 mmol) in xylene (5 ml) was heated under reflux for 10 min. After cooling, the mixture was evaporated and the resulting residue treated with Et$_2$O to give a precipitate. The solid was collected and recrystallized from little AcOEt to give, after drying in a vacuum desiccator, 0.15 g (33%) of **70**. Yellowish crystals. M.p. 165°. UV (MeOH): 236 (4.27), 251 (sh, 4.06), 294 (4.28). ^{1}H-NMR ((D$_6$)DMSO): 8.60 (*s*, CH≡N$^+$); 3.93 (*m*, 2 CH$_2$N); 1.75 – 1.55 (*m*, 2 C*H*$_2$CH$_2$N); 0.90 (*m*,

2 *Me*CH_2CH_2N). Anal. calc. for $C_{12}H_{15}N_5O_2$ (261.3): C 55.16, H 5.79, N 26.80; found: C 55.16, H 5.80, N 26.76.

*1,2,3,6-Tetrahydro-1,3,8-trimethyl-2,6-dioxo-9*H*-purine-9-carbonitrile* (**71**). a) A soln. of **63** (0.233 g, 1 mmol) in xylene (5 ml) was heated under reflux for 10 min. The solvent was evaporated and the residue recrystallized from MeOH to give, after drying, 0.13 g (60%) of **71**. Colorless crystals. M.p. 148°.

b) In an oven, **63** (0.233 g, 1 mmol) was heated to 100° and kept at this temp. for 9 days. The solid was recrystallized from EtOH to give 1.64 g (75%) of **71**. Colorless crystals. M.p. 148°. UV (MeOH): 204 (4.10), 245 (4.02), 266 (sh, 3.85). ^{1}H-NMR ((D$_6$)DMSO): 3.66 (*s*, Me–N(3)); 3.23 (*s*, Me–N(1)); 2.54 (*s*, Me–C(8)). ^{13}C-NMR ((D$_6$)DMSO): 155.64; 149.85; 145.30; 140.19; 113.57; 103.39; 30.27; 28.20; 13.01. Anal. calc. for $C_9H_9N_5O_2$ (219.2): C 49.31, H 4.14, N 31.95; found: C 48.96, H 4.15, N 32.03

*1,2,3,6-Tetrahydro-8-isopropyl-1,3-dimethyl-2,6-dioxo-9*H*-purine-9-carbonitrile* (**72**). A soln. of **64** (0.275 g, 1 mmol) in xylene (5 ml) was heated under reflux for 5 min. The solvent was evaporated and the residue recrystallized from MeOH to give, after drying, 0.18 g (73%) of **72**. Colorless crystals. M.p. 174°. UV (MeOH): 247 (4.10), 270 (sh, 3.89). ^{1}H-NMR ((D$_6$)DMSO): 3.71 (*s*, Me–N(3)); 3.21 (*s*, Me–N(1)); 3.19 (*m*, Me_2CH); 1.33 (*d*, Me_2CH). ^{13}C-NMR ((D$_6$)DMSO): 155.80; 152.77; 149.90; 140.35; 113.34; 103.35; 30.32; 28.22; 26.86; 20.14. Anal. calc. for $C_{11}H_{13}N_5O_2$ (247.3): C 53.43, H 5.30, N 28.33; found: C 53.53, H 5.42, N 28.52.

*1,2,3,6-Tetrahydro-1-methyl-2,6-dioxo-9*H*-purine-9-carbonitrile* (**73**). A suspension of **62** (0.219 g, 1 mmol) in dry xylene (100 ml) was heated under reflux for 1 h. The precipitate was filtered off the warm soln., washed with EtOH and Et_2O, and dried at 100° in the oven: 0.115 g (60%) of **73**. Colorless crystals. M.p. >320°. UV (MeOH): 250 (3.98), 262 (sh, 3.94). IR: 2245. ^{1}H-NMR ((D$_6$)DMSO): 11.85 (*s*, H–N(3)); 8.36 (*s*, H–C(8)); 3.18 (*s*, Me–N(1)). Anal. calc. for $C_7H_5N_5O_2$ (191.15): C 43.98, H 2.64, N 36,64; found: C 43.89, H 2.74, N 36.43.

*8-Amino-3,7-dihydro-1,3-dimethyl-1*H*-purine-2,6-dione* (**74**). a) A suspension of **11** (0.12 g, 0.58 mmol) in EtOH (50 ml) was heated under reflux for 2 h. The precipitate was collected after cooling: 94 mg (83%) of **74**, identical with authentic material by UV and ^{1}H-NMR. Colorless crystals. M.p. >300° ([41]: >300°). UV (MeOH): 211 (4.39), 289 (4.22). ^{1}H-NMR ((D$_6$)DMSO): 11.37 (*s*, NH); 6.52 (*s*, NH_2); 3.32 (*s*, Me–N(3)); 3.17 (*s*, Me–N(1)).

b) A soln. of **1** (0.47 g, 0.2 mmol) in pentan-1-ol (10 ml) was heated under reflux for 20 min. From the clear soln. separated, after *ca.* 5 min, a precipitate which was collected after cooling. Purification was achieved by dissolution in dil. HCl soln., treatment with charcoal, filtration, and neutralization of the hot filtrate by ammonia: 0.18 g (46%) of **74**. Colorless crystal powder. M.p. >300°.

*3,7-Dihydro-1,3-dimethyl-1*H*-purine-2,6-dione* (= *Theophylline*; **75**). a) A soln. of **5** (0.102 g, 0.5 mmol) in H_2O (15 ml) was heated under reflux for 60 min. The solvent was evaporated and the residue recrystallized from EtOH: 75 mg (77%) of **75**. Colorless crystals. M.p. 270° ([42]: 268–270°).

b) A soln. of **1** (0.205 g, 1 mmol) in *N,N*-dimethylacetamide (5 ml) was heated under reflux for 15 min. The solvent was evaporated and the residue recrystallized from EtOH with little charcoal: 90 mg (50%) of **75**. Colorless crystals. M.p. 270°.

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Received October 22, 2007