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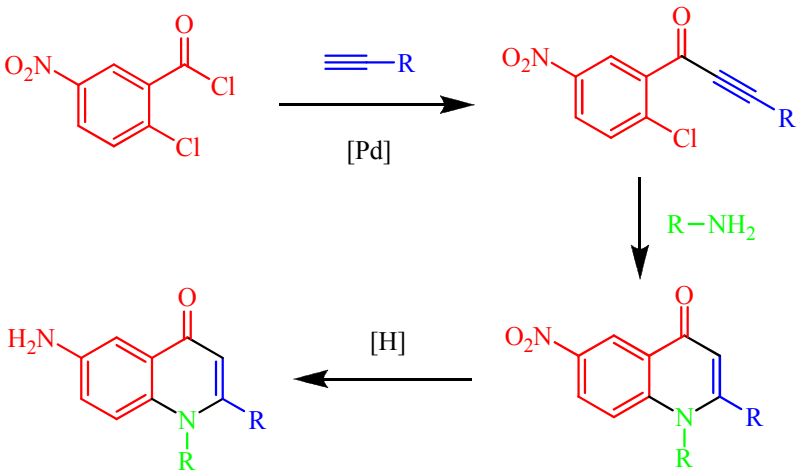

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Diversity oriented synthesis of 6-Nitro- and 6-Aminoquinolones and their activity as alkaline phosphatase inhibitors

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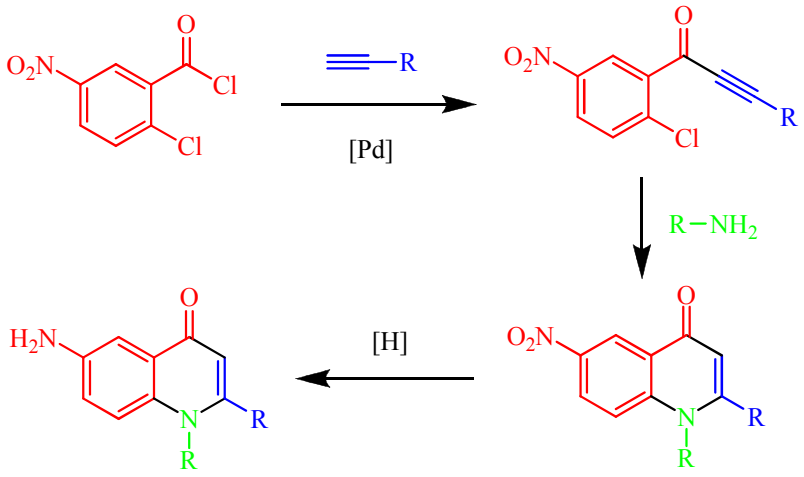
Abstract: The novel Quinolone derivatives synthesized by cyclization of α,β-ynones with primary amines were shown to be promising TNAP and IAP inhibitors. The mechanism of their formation was studied by the isolation of intermediates.

Keywords: heterocycles, quinolone, amines, cyclization, palladium.



Introduction

Alkaline phosphatases (APs) are ubiquitous ectoenzymes widely distributed in nature from bacteria to humans, suggesting their involvement in important physiological processes. Their main functions consist of catalyzing dephosphorylation and transphosphorylation reactions on a broad spectrum of physiological and non-physiological substrates.[1] AP isozymes, encoded by four homologous gene loci, are present in humans and mice. Three of them, known as the placental (PLAP), germ cell (GCAP) and intestinal (IAP) types are tissue-specific with highly restricted expression, while the fourth isozyme, tissue nonspecific AP (TNAP) is present in numerous tissues but particularly abundant in mineralizing tissues, the kidneys and the central nervous system (CNS).[2]

TNAP is encoded in humans by the AP (alkaline phosphatase, liver/bone/kidney) gene and by the Akp2 (alkaline phosphatase 2) gene in mice, both with 12 exons. In both species, two different transcripts derived from the same coding region have been described. Similar to the rest of the mammalian AP family, TNAP is a homodimeric protein anchored to the cytoplasmic membrane via two GPI moieties.[3] Each monomer contains three metallic ions (two zinc molecules and one of magnesium) and one phosphate ion. The central core of each subunit consists of an extended β-sheet flanked by α-helices. Other two identifiable regions are the long N-terminal α-helix and an interfacial flexible loop known as the "crown domain".[4]

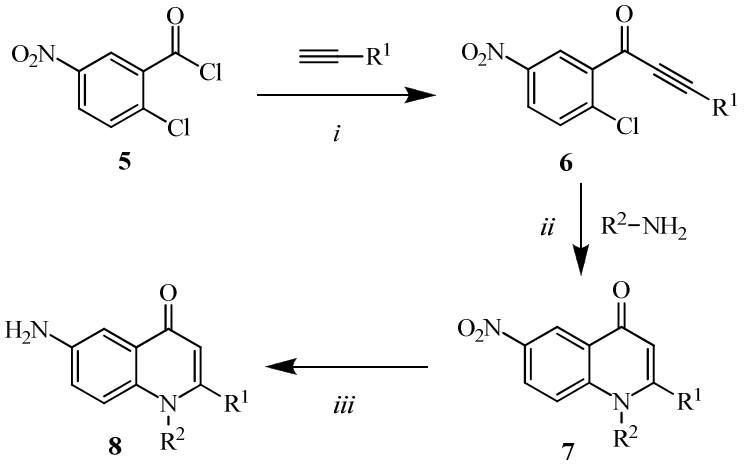
TNAP hydrolyzes extracellular inorganic pyrophosphate (PPi), a potent mineralization inhibitor, to enable the physiological deposition of hydroxyapatite in bones and teeth. Deficiency of TNAP due to gene mutation is responsible for the severe disorder of bones and elevated levels of extracellular PPi.[5] On the other hand unnecessary deposition of hydroxyapatite together with other forms of calcium phosphate in soft tissues results in over expression of TNAP and hipper calcification in smooth muscle cells of kidney and vessels. It provokes the progress of such serious diseases as end-stage renal disease, idiopathic infantile arterial calcification, ankylosis, osteoarthritis and diabetes. Therefore, there is need to develop potent inhibitors of TNAP and IAP which could be useful as therapeutic agents in the treatment of human atherosclerotic lesions.[6]

By keeping in view the literature findings and our continued interest in the development of potent inhibitors of alkaline phosphatases, we report a short, convenient and efficient method for the catalyst-free one-pot synthesis of 6-nitro-4-quinolones, which could be readily transformed to 6-amino-4-quinolones. The synthesized derivatives were investigated as new a class of inhibitors of alkaline phosphatases: tissue-nonspecific alkaline phosphatase (TNAP) and tissue specific intestinal alkaline phosphatase (IAP). 4-Quinolones are of considerable pharmacological

relevance and a number of derivatives are used in the clinic.[7-13] A variety of synthetic strategies have been developed for the synthesis of 4-quinolones.[14-21] A general and modern method for the quinolone synthesis relies on cyclization reactions of ynones.[22-25] Recently we have developed a synthetic concept for the assembly of several fused 4-pyridones, namely, fluorinated 4-quinolones,[26] 1,8-naphthyridin-4(1*H*)-ones,[27] benzo[*b*][1,8]naphthyridin-4(1*H*)-ones,[28] pyrido[2,3-*b*]quinoxalin-4(1*H*)-ones[28] and thieno[3,2-*b*]pyridin-4(1*H*)-ones.[29] Most of this work relies on transition metal catalysed cyclizations of alkynes with amines. Herein, we report a convenient catalyst-free one-pot synthesis of 6-nitro-4-quinolones which could be readily transformed to 6-amino-4-quinolones. The synthetic strategy has been previously efficiently applied by Shao at all for the synthesis of N-alkyl-substituted quinolone derivatives via tandem C-N bond-forming process.[22] Cacchi`s group reported a similar methodology for Quinolone synthesis, whereas, the intermediates had to be isolated and CuI catalysis was required.[23] However, the information about ring substitution is still lacking. Herein we report the synthesis of nitro- and amino-substituted quinolones which have, to the best of our knowledge, not been prepared. Moreover, considering that an aryl substituent can improve lipophilicity and action period of a drug we include N-aryl- as well as N-alkyl-derivatives to the new batch. The mechanism of the approach reported herein was studied based on the isolation of intermediates. The nitro- and aminoquinolones prepared in the current study show a considerable activity as TNAP and IAP inhibitors.

Results and Discussion

Chemistry. Ynones **6a-d** were prepared using a known procedure by Sonogashira cross-coupling reaction of benzoic acid chloride **5** with the appropriate acetylenes using $Pd(PPh_3)_2Cl_2$ and CuI as catalysts (Table 1, Scheme 1).[30, 31] For the isolation of **6a-d**, the use of column chromatography was necessary which resulted in some loss of material, due to partial decomposition on silica. The reaction of ynones **6** with aliphatic and aromatic amines afforded a variety of 6-nitro-4-quinolones **7** (Scheme 1, Table 2). In general, the cyclization proceeded in lower yields with anilines than with aliphatic amines which are more nucleophilic. The best yields of the desired products were obtained when the reactions were carried out at 120 °C in the presence of potassium carbonate (for aliphatic amines) or potassium phosphate (for aromatic amines) in DMF (reaction time: 6-10 h). The hydrogenation of products **7** under classical conditions (H_2, 10% Pd/C, MeOH) readily afforded 6-amino-4-quinolones **8** in generally good to excellent yields. However, brominated quinolone **7aq** underwent reduction of the bromine atom to a hydrogen atom to give the dehalogenated product **8ak**.

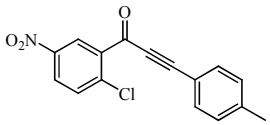
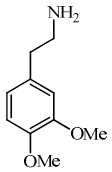
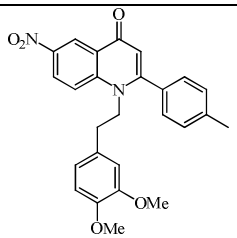
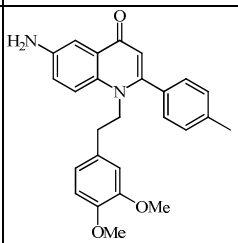


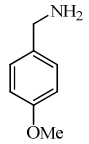
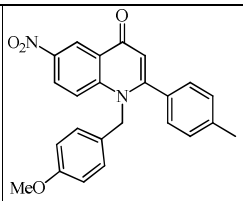
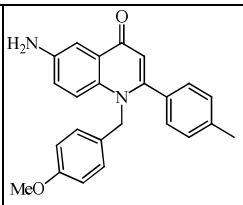
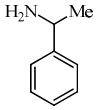
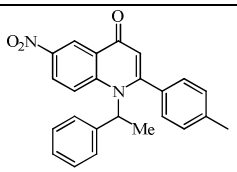
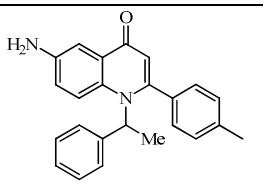
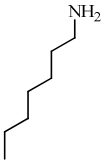
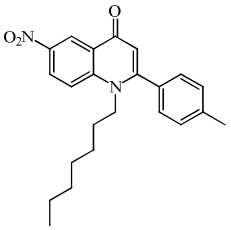
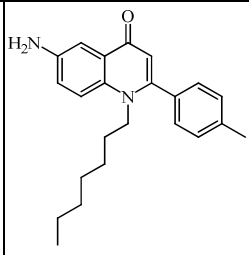
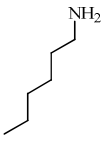
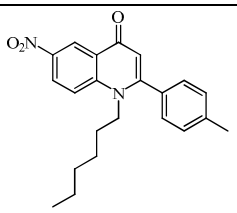
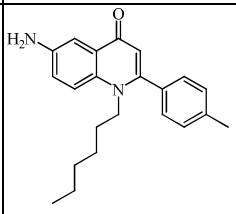
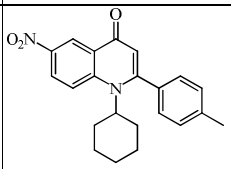
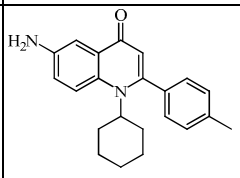
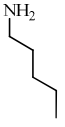
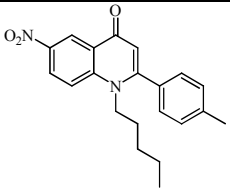
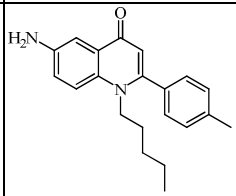
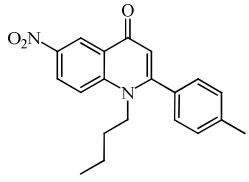
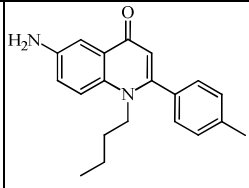
Scheme 1. Synthesis of 6-nitro-4-quinolones **7** and 6-amino-4-quinolones **8**. *Reagents and conditions*: *i*, $Pd(PPh_3)_2Cl_2$ (0.01 equiv.), CuI (0.02 equiv.), THF, NEt_3 (1.3 equiv.), appropriate alkyne (1.3 equiv.), 20 °C, 6 h; *ii*, appropriate amine (1.7 equiv.), K_2CO_3 (2 equiv.), DMF, 120 °C, 7 h; *iii*, H_2, 10% Pd/C, MeOH, 20 °C, 4 h

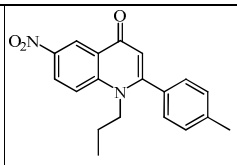
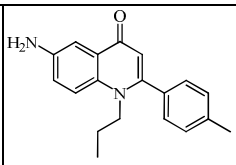
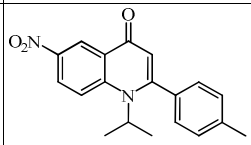
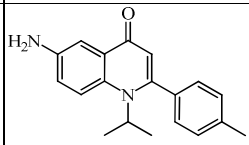
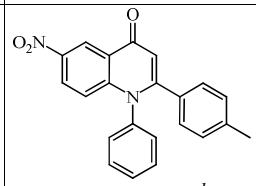
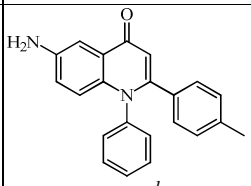
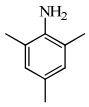
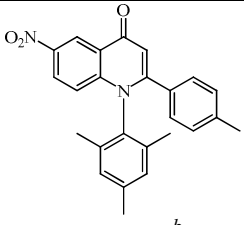
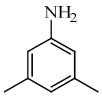
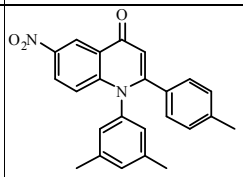
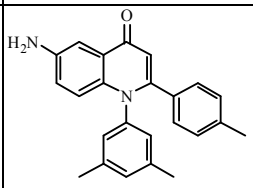
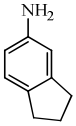
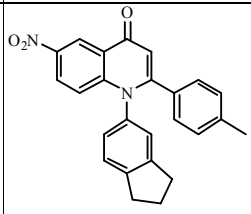
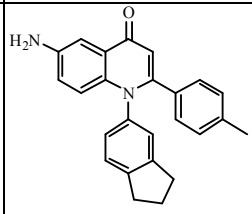
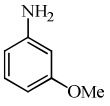
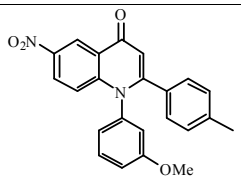
Table 1. Synthesis of α,β-ynones **6**.

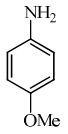
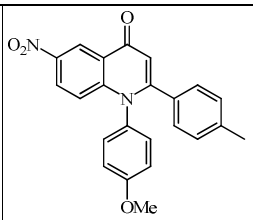
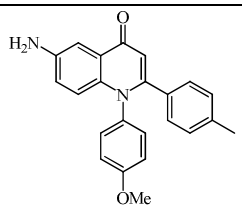
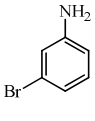
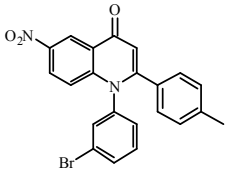
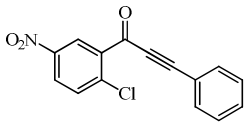
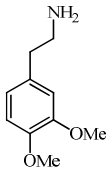
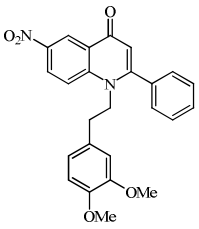
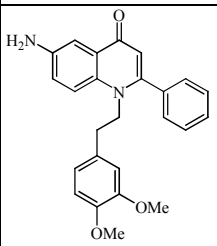
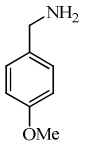
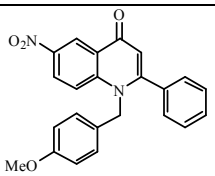
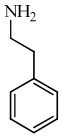
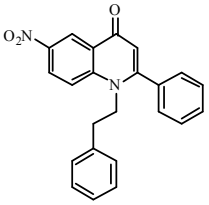
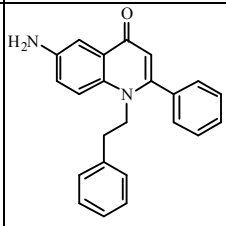
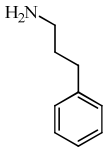
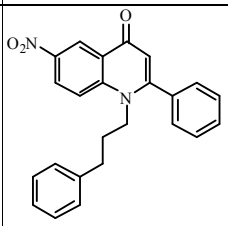
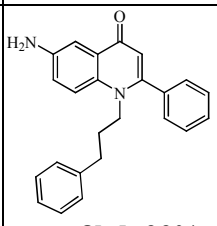
Entry	**6**	R^1	Isolated yield, %
1	**a**	4-(Me)C_6H_4	76
2	**b**	C_6H_5	65
3	**c**	*n*-C_4H_9	75
4	**d**	*n*-C_5H_{11}	78

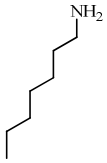
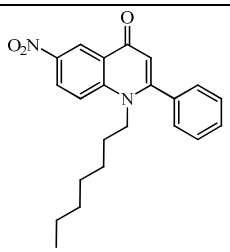
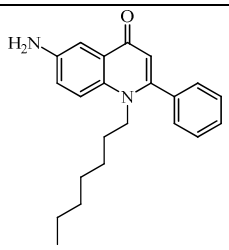
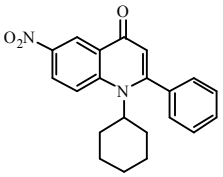
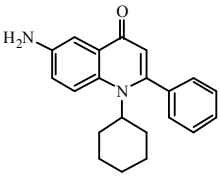
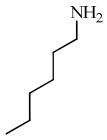
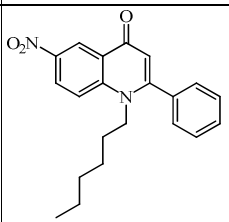
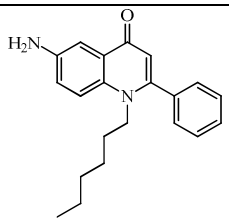
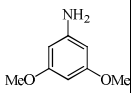
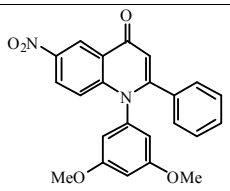
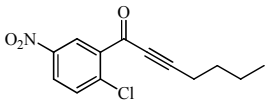
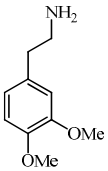
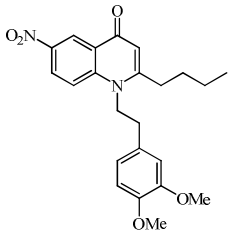
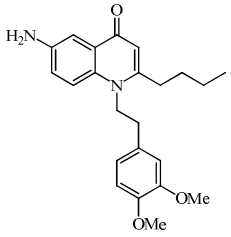
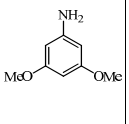
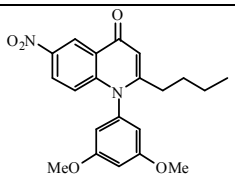
Table 2. Synthesis of 6-nitro-4-quinolones **7** and 6-amino-4-quinolones **8**.

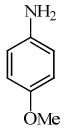
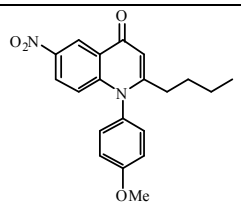
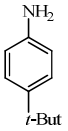
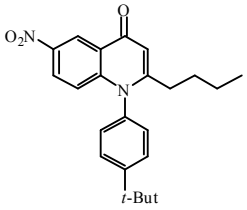
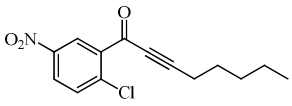
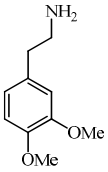
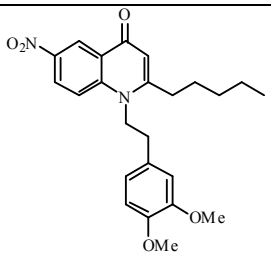
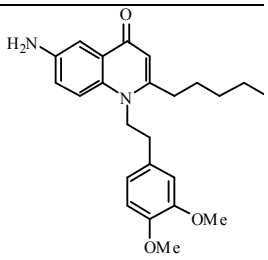
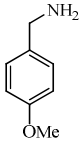
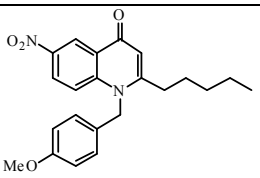
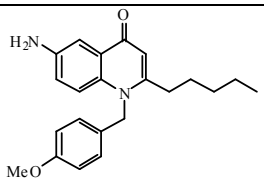
Substrate **6**	Amine	Products **7** [a] Isolated yield	Products **8** [c] Isolated yield
 **6a**, 76%		 **7aa**, 51%	 **8aa**, 64%

6a		 **7ab**, 83% / 23% [g]	 **8ab**, 89%
6a		 **7ac**, 87%	 **8ac**, 62%
6a		 **7ad**, 72%	 **8ad**, 77%
6a		 **7ae**, 55%	 **8ae**, 82%
6a		 **7af**, 60%	 **8af**, 68%
6a		 **7ag**, 71%	 **8ag**, 99%
6a		 **7ah**, 79%	 **8ah**, 99%

6a		 **7ai**, 87%	 **8ai**, 97%
6a		 **7aj**, 82% / 17% [g]	 **8aj**, 85%
6a		 **7ak**, 64%[b]	 **8ak**, 81%[d] / 56%[e]
6a		 **7al**, 65%[b]	*f*
6a		 **7am**, 61%	 **8am**, 85%
6a		 **7 an**, 62%	 **8an**, 31%
6a		 **7ao**, 55%[b]	*f*

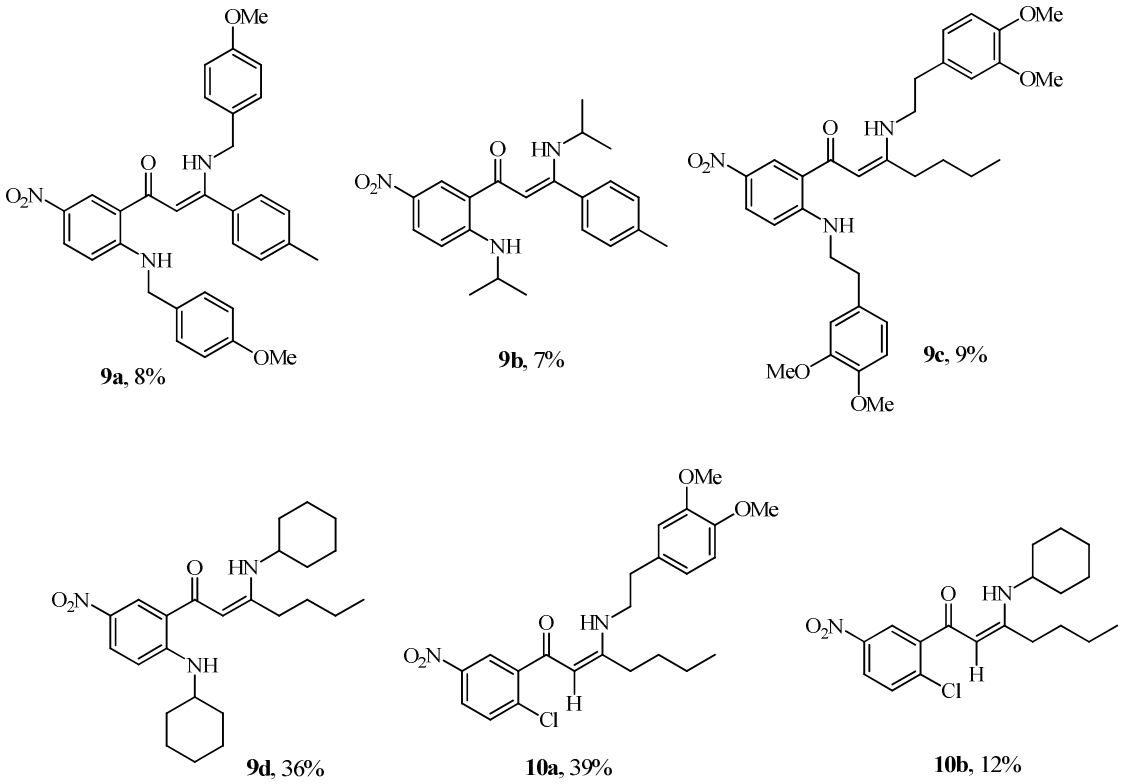
6a		 **7ap**, 71%[b]	 **8ap**, 85%
6a		 **7aq**, 48%[b]	*f*
 **6b**, 65%		 **7ba**, 89%	 **8ba**, 81%
6b		 **7bb**, 61%	*f*
6b		 **7 bc**, 79%	 **8bc**, 99%
6b		 **7 bd**, 66%	 **8bd**, 99%

6b		 **7be**, 90%	 **8be**, 75%
6b		 **7bf**, 60%	 **8bf**, 99%
6b		 **7 bg**, 81%	 **8bg**, 80%
6b		 **7 bh**, 47%[b]	*f*
 **6c**, 75%		 **7ca**, 82% / 14% [h]	 **8ca**, 99%
6c		 **7cb**, 39%	*f*

6c		 **7cc**, 72%[b]	*f*
6c		 **7cd**, 42%[b]	*f*
6c		*i*	*f*
 **6d**, 78%		 **7da**, 60%	 **8da**, 98%
6d		 **7db**, 51%	 **8db**, 99%

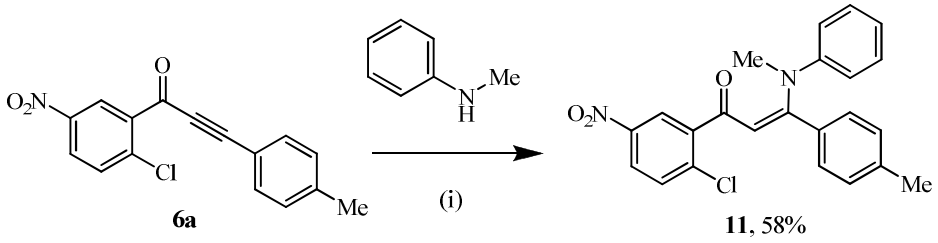
[a] Standard conditions for aliphatic amines: 1.7 equiv. appropriate amine, 2 equiv. K_2CO_3, DMF, 120 °C, 6-8 h; [b] alternative conditions for aromatic amines: 1.7 equiv. primary amine, 2 equiv. K_3PO_4, DMF, 120 °C, 6-10 h; [c] standard conditions: Methanol, 0.1 equiv. 10% Pd/C, H_2, 20 °C, 4-5 h; [d] yield of the product **8ak** obtained from substrate **7 ak**; [e] yield of the product **8ak** obtained from the substrate **7aq**; [f] experiment was not performed; [g] specific conditions for the isolation of **9a** and **9b**: 1.7 equiv. of the appropriate amine, 2 equiv. KF, DMF, 120 °C, 10 h; [h] specific conditions for isolation of **9c** and **10a**: 1.7 equiv. appropriate amine, 2 equiv. KF, DMF, 120 °C, 4 h; [i] specific conditions for isolation of **9d** and **10b**: 1.7 equiv. cyclohexylamine, 2 equiv. KF, DMF, 60 °C, 10 h. In this case **7** was not formed.

During the optimization of the conditions of the cyclization, we were able to isolate side-products **9** and **10** (Scheme 2). The quantity of these compounds strongly depends on the conditions (see legend of Table 2). The formation of products **9** can be explained by reaction of **6** with two molecules of the amine, i.e. conjugate addition to the ynone and nucleophilic substitution at the arene. Products **10** are formed by conjugate addition of the amine to the alkynone moiety. Under the standard conditions applied for the synthesis of quinolones **7**, side-products **9** and **10** were formed only in very small quantities (1-2%). However, **9a-d** could be isolated and spectroscopically characterized when the reaction was carried out at lower temperature. Reduction of the reaction time during the synthesis of nitroquinolone derivatives allowed us to isolate intermediates **10a** and **10b**. In general, the yields of unwanted side-products **9** and **10** increased when potassium fluoride was employed instead of standard K_2CO_3 and K_3PO_4.



Scheme 2. Side-products **9** and **10**. Yields of isolated compounds obtained in reaction conditions specified in footnotes *g*, *h*, and *i* of Table 2.

To study the mechanism of the cyclization, we heated compounds **10** under standard conditions (footnote *a* of Table 2). In fact, products **10a** and **10b** were converted into quinolones **7**. In contrast, heating of compound **9** resulted in no conversion. This result suggests that mono-adducts **10a** and **10b** can be regarded as intermediates of the cyclization reaction, whereas bis-adducts **9** are by-products and are not involved in the reaction mechanism. Therefore, it can be anticipated that the first step of the formation of **7** proceeds by conjugate addition of the amine to the ynone. In the second step, the cyclization takes place by an intermolecular nucleophilic substitution of the chlorine atom of the benzene moiety. The leaving group is strongly activated by the nitro group located in *para* position. The suggested mechanism is also confirmed by the following observation: the reaction of *N*-methylaniline with ynone **6** afforded product **11** in good yield (Scheme 3). This product cannot undergo a further cyclization because of the complete substitution of the nitrogen atom. The high yield of **11** suggests that the first attack of the amine occurs at the ynone and not at the arene moiety of **6**. Indeed, related reactions were previously reported.[23]



Scheme 3. Reaction of **6a** with a secondary amine. *Reagents and conditions*: (i) 1.7 equiv. *N*-methylaniline, 2 equiv. K_3PO_4, DMF, 120 °C, 8 h.

The cyclization of **6a** with aliphatic diamines afforded bis(4-quinolones) **12a** and **12b** in good yields (Scheme 4). The synthesis of bis(quinolones) containing two quinolone fragments using 6-amino-4-quinolones **8** as starting materials was next studied. The reaction of **8ai** and **8aj** with ynone **6a** afforded the desired bis(quinolones) **13a** and **13b**, albeit, in rather low yield. The low yields can be explained by the low nucleophilicity of the amino group of 6-aminoquinolones **8**.

The structures of 4-nitroquinolones **7ab**, **7ac**, and **7bd** were independently confirmed by X-ray crystallographic analyses (Figures 1-3). [32]

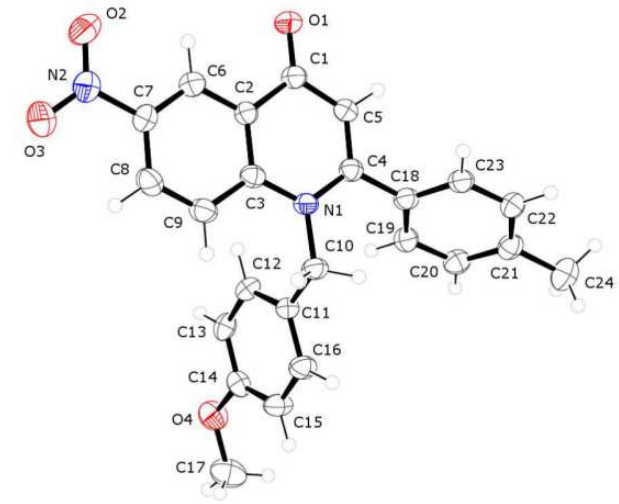


Figure 1. Molecular structure of compound **7ab**

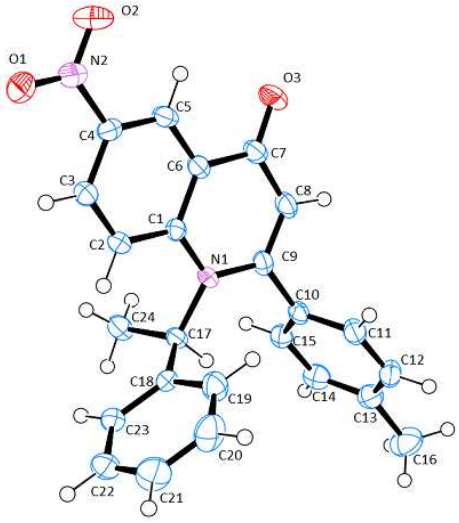


Figure 2. Molecular structure of compound **7ac**

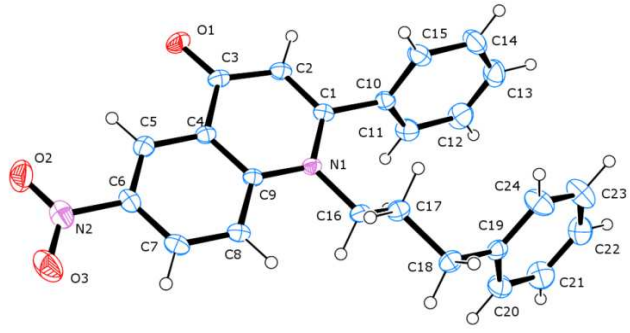
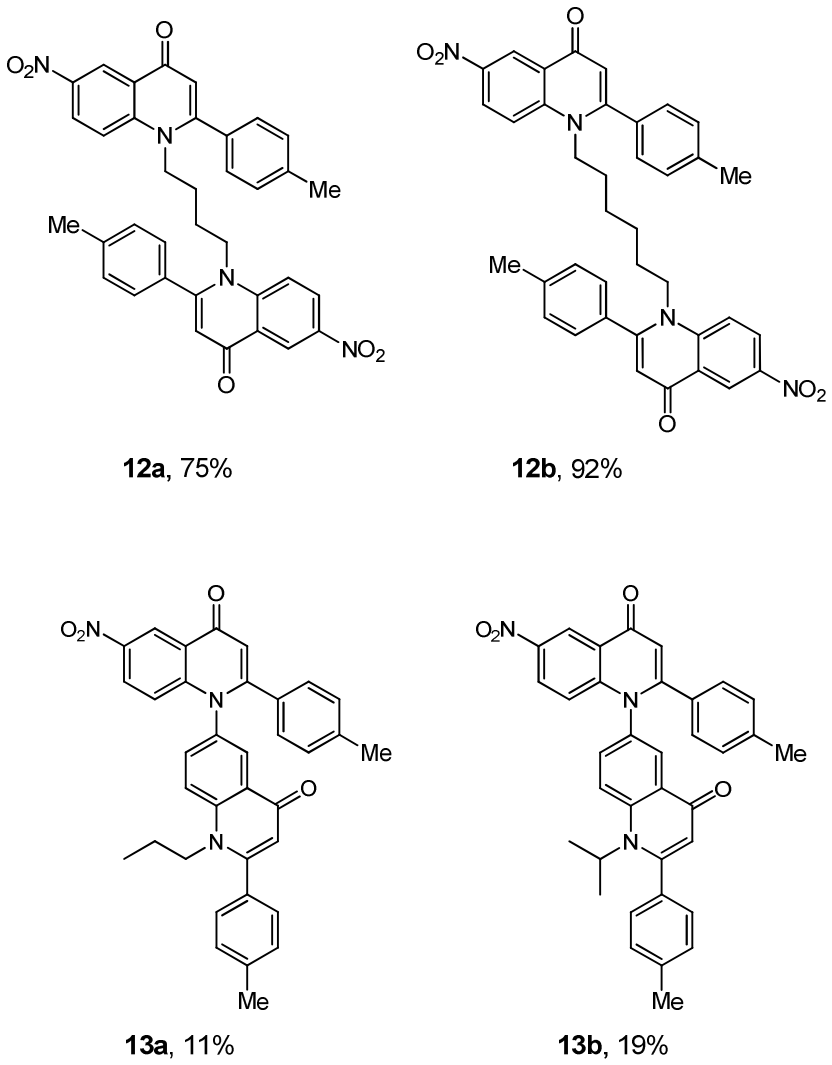


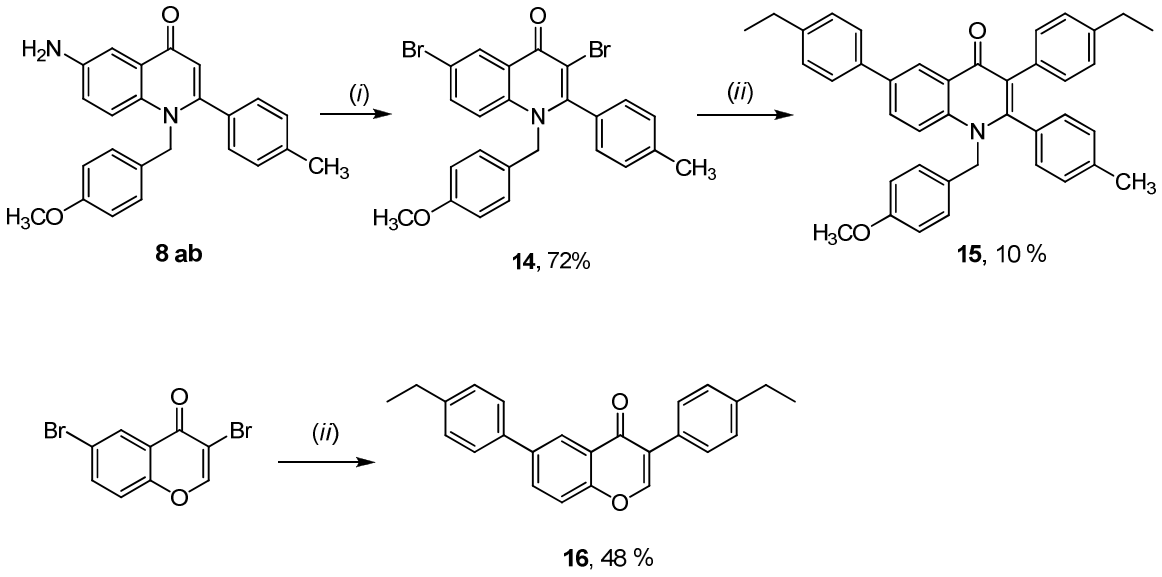
Figure 3. Molecular structure of compound **7bd**



Scheme 4. Bis(quinolones) **12a**,**b** and two-unit chains of 4-quinolones **13a**,**b**

The reaction of 6-aminochromone **8ab** with $CuBr_2$ and *t*-butyronitrite afforded dibrominated quinolone **14** in 72% yield. The Suzuki-Miaura reaction of **14** with 4-ethylphenylboronic acid afforded diarylated quinolone **15**, albeit, in low yield. Due to the low yield, Pd catalyzed cross-coupling reactions of dibromide **14** were not further studied. In contrast, the Suzuki-Miaura reaction of known 3,6-dibromochromone gave product **16** in 48% yield (Scheme 5). The structures of **15** and **16** were independently confirmed by X-ray crystal structure analyses (Figures 4 and 5). The measured crystal of **15** contains small amounts (about 3%) of the 6-aryl-3-

bromo derivative, which was formed as an intermediate product during the Suzuki-Miaura coupling reaction.



Scheme 5. Modification of the C-6 and C-3 positions in 4-quinolone and chromone. *Reagents and conditions*: (i) *t*-$BuNO_2$, $CuBr_2$, acetonitrile; (ii) **8ab** or 3,6-dibromo-4*H*-chromen-4-one, 1.2 equiv. of aryl boronic acid, 0.1 equiv. of $Pd(PPh_3)_4$, 10 equiv. K_2CO_3, toluene / H_2O MeOH = 5.5/1/1.5, 90 °C, 4 h.

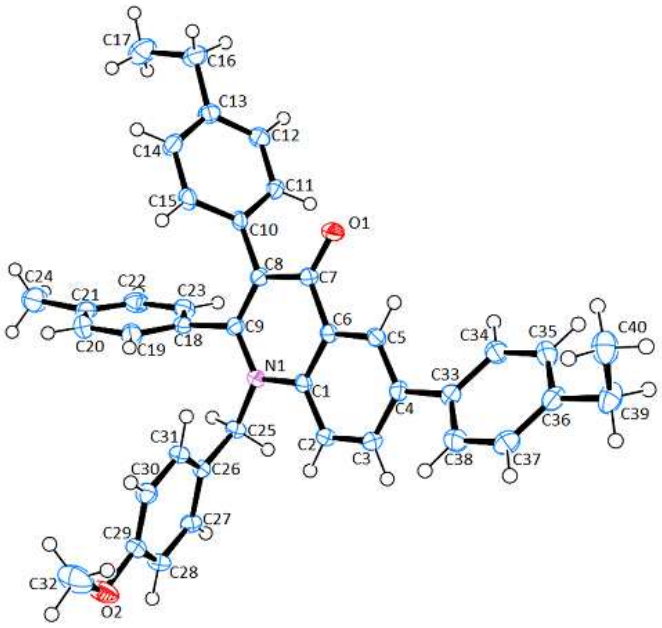


Figure 4. Molecular structure of compound **15**

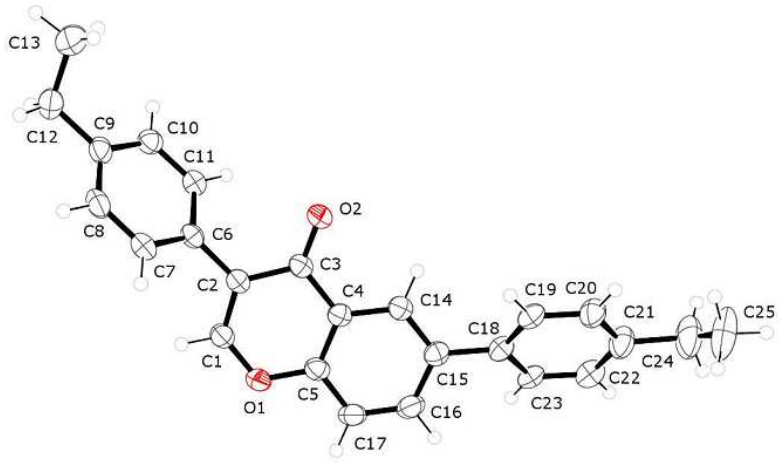


Figure 5. Molecular structure of compounds **16**

Alkaline Phosphatase Inhibition Assay. We tested the activity of 6-nitroquinolones **7** and 6-aminoquinolones **8** as inhibitors of bovine kidney alkaline phosphatase enzyme (TNAP) and intestinal alkaline phosphatase enzyme (IAP). A chemiluminescent substrate, CDP-star, was used for the determination of alkaline phosphatase activity. The conditions for the assay were optimized with slight modifications of the previously used spectrophotometric method.[33]

Table 3. Tissue non-specific alkaline phosphatase (b-TNAP) and intestinal alkaline phosphatase (c-IAP) inhibition data for the synthesized compounds.

Codes	b-TNAP	c-IAP	Codes	b-TNAP	c-IAP
	IC_{50} [a] (μM) ± SEM or (% inhibition)[b]	IC_{50} [a] (μM) ± SEM or (% inhibition)[b]		IC_{50} [a] (μM) ± SEM or (% inhibition)[b]	IC_{50} [a] (μM) ± SEM or (% inhibition)[b]
7aa	11.2±1.11 [a]	19.1±0.76 [a]	**8aa**	31.9±1.23 [a]	2.63±0.99 [a]
7ab	132.6±1.78 [a]	48.65% [b]	**8ab**	9.25±0.88 [a]	23.3±1.54 [a]
7ac	17.9±2.45 [a]	4.75±0.45 [a]	**8ac**	2.87±0.04 [a]	45.21% [b]
7ad	59.6±2.67 [a]	31.2±2.11 [a]	**8ad**	1.77±0.001 [a]	34.5±1.23 [a]
7ae	12.5±1.06 [a]	23.1±1.09 [a]	**8ae**	78.1±1.56 [a]	45.67% [b]
7af	1.74±0.002 [a]	1.75±0.009 [a]	**8af**	37.4±2.33 [a]	35.98% [b]
7ag	43.2±3.55 [a]	10.9±0.33 [a]	**8ag**	9.74±1.07 [a]	4.36±0.21 [a]

7ah	4.56±0.33[a]	5.88±0.13[a]	**8ah**	5.84±0.99[a]	0.797±0.01[a]
7ai	22.9±3.11[a]	4.96±0.98[a]	**8ai**	30.4±1.34[a]	11.4±1.21[a]
7aj	11.6±0.22[a]	132.4±2.45[a]	**8ak**	4.33±0.66[a]	39.8±1.34[a]
7ak	21.9±2.11[a]	1.51±0.002[a]	**8am**	7.59±0.56[a]	34.56%[b]
7al	4.71±0.34[a]	10.3±1.56[a]	**8an**	1.98±0.01[a]	0.443±0.002[a]
7am	20.4±1.98[a]	54.7±2.15[a]	**8ap**	49.1±2.15[a]	16.6±0.76[a]
7an	3.13±0.22[a]	3.32±0.08[a]	**8ba**	6.61±0.89[a]	21.34%[b]
7ao	2.91±0.11[a]	11.3±0.65[a]	**8bc**	4.45±0.03[a]	4.71±0.43[a]
7ap	12.8±1.21[a]	4.26±0.33[a]	**8bd**	3.24±0.02[a]	13.2±0.97[a]
7aq	11.8±0.98[a]	73.3±1.76[a]	**8be**	10.2±1.76[a]	48.98%[b]
7ba	6.34±0.23[a]	12.33[b]	**8bf**	17.4±1.09[a]	154.2±1.34[a]
7bc	4.17±0.21[a]	54.3±0.43[a]	**8bg**	2.13±0.03[a]	48.65%[b]
7bd	11.8±0.11[a]	10.7±0.44[a]	**8ca**	4.16±0.23[a]	18.1±1.21[a]
7be	9.72±0.99[a]	23.6±1.33[a]	**8da**	29.7±2.11[a]	176.4±2.34[a]
7bf	7.62±0.22[a]	15.4±0.11[a]	**12a**	1.14±0.65[a]	1.24±0.04[a]
7bg	3.98±0.06[a]	2.87±0.02[a]	**12b**	4.17±0.99[a]	5.91±0.66[a]
7bh	3.39±0.001[a]	1.59±0.91[a]	**13a**	2.55±0.03[a]	10.7±0.98[a]
7ca	134.1±3.66[a]	6.44±0.99[a]	**13b**	9.46±1.23[a]	0.531±0.01[a]
7cb	1.43±0.08[a]	21.9±0.87[a]	**14**	6.06±1.01[a]	4.75±0.09[a]
7cd	11.2±1.23[a]	8.32±1.22[a]	**16**	40.9±1.23[a]	1.41±0.08[a]
7db	1.51±0.006[a]	1.38±0.01[a]	**17a**	10.1±1.12[a]	8.26±1.45[a]
Levamisole	19.21±0.001[a]	-------			
L-Phenyl alanine	-------	80.21±0.001[a]			

[a] The IC_{50} is the concentration at which 50% of the enzyme activity is inhibited. [b] The % inhibition of the enzyme activity caused by 0.2 mM of the tested compounds

Synthesized quinoline derivatives were analysed against two isozymes of alkaline phosphatase, i.e. b-TNAP and c-IAP. By varying the substituents located at the heterocyclic core structure, various derivatives were synthesized, including 6-amino quinoline and 6-nitro quinolones. All these derivatives were active against b-TNAP and c-IAP with some exceptions. All nitroquinolones **7** were active against TNAP and the inhibitory values were in the range of IC_{50} ± SEM = 1.43±0.08 to 134.1±3.66 μM. Besides the inhibition, the selectivity represents an important issue. Among these, **7ba** was found to be a very potent and, in addition, a selective inhibitor of b-TNAP having an inhibitory value of IC_{50} ± SEM = 6.34±0.23μM. This compound showed a threefold higher potential as compared to the reference standard used in the assay, i.e. Levamisole with a value of IC_{50} ± SEM = 19.21±0.001μM. A detailed study of the structure revealed that the selective activity might be due to the presence of the 3,4-(dimethoxyphenyl)ethyl substituent located at the nitrogen and an aryl group located at position 2 of the 6-nitroquinolone ring. Compound having an alkyl group located at position 2 of the quinolone moiety, i.e. derivatives **7cb** and **7db**, displayed a significant inhibitory activity against b-TNAP, with IC_{50} ± SEM = 1.43±0.08 and 1.51±0.006 μM, respectively. Compounds having an

alkyl substituent located at the nitrogen atom, such as **7ab**,**7ad**, **7ag** and **7aj**, are inactive or show a low activity against TNAP. All these derivatives remain active against c-IAP, except two compounds. All 6-nitroquinolones displayed inhibitory activity against C-IAP in the range of IC_{50} ± SEM = 1.38±0.01 to 132.4±2.45 μM. Derivative **7af**, containing a cyclohexyl and a tolyl substituent, shows a high activity against both TNAP and C-IAP with IC_{50} ± SEM = 1.74±0.002 and 1.75±0.009 μM, respectively. Compounds bearing aryl substituents at position 2 display a significant activity against c-IAP, irrespective of the type of substituent located at position 1.

All Aminoquinolones displayed a remarkable activity against b-TNAP in the range of IC_{50} ± SEM = 1.14±0.65 to 78.1±1.56 μM. Most of these compounds were found to be selective inhibitors of b-TNAP, however, some compounds were also active against c-IAP. A detailed study of the structure suggested that all compounds showing a potent activity against TNAP contain an aromatic ring located at position 2 of the quinolone. The presence of an alkyl group reduced the bioactivity. The activity against c-IAP were in the range of IC_{50} ± SEM = 0.443±0.002 to 176.4±2.34 μM. The structure activity relationship elucidated that the presence of a bulky group or of a hydrophobic group located at the nitrogen atom results in a significant increase of the inhibitory effect against C-IAP. Compound **8an** has been found to be the most potent derivative showing a IC_{50} value of IC_{50} ± SEM = 0.443±0.002.

Two compounds of the series, i.e. **8ah** and **16**, contain a chromene substructure. These compounds were found to be more active against c-IAP than against b-TNAP. The inhibitory values against c-IAP were IC_{50} ± SEM = 0.797±0.01 and 1.41±0.08 μM, respectively. In contrast, against b-TNAP, these compound showed IC_{50} ± SEM = 5.84±0.99 to 40.9±1.23 μM.

Conclusions

A diversity orientated synthesis of biologically relevant novel 6-nitro- and 6-amino-4-quinolones was reported. The products were obtained in good to excellent yields. The operational simplicity of the methodology is remarkable. The methodology has a broad applicability with regard to the scope. A variety of products show a high and selective inhibition of enzyme alkaline phosphatase.

Experimental Section

General information. NMR spectra were recorded on Bruker Avance 250 (250 MHz), Brucker Avance 300 (300 MHz) and Brucker Avance 500 (500 MHz). Chemical shifts (ppm) are given relative to solvent: references for $CDCl_3$ were 7.26 ppm (^{1}H-NMR) and 77.16 ppm (^{13}C-NMR); references for DMSO-d_6 were 2.54 ppm (^{1}H-NMR) and 39.50 ppm (^{13}C-NMR). Multiplets were assigned as s (singlet), d (doublet), t (triplet), q (quartet), p (pentet), m (multiplet), br s (broad singlet). All measurements were carried out at room temperature unless otherwise stated. IR spectra were recorded on a Nicolet 6700 FT-IR spectrometer (ATR). A wavelength is given in cm^{-1}. Abbreviations: s = strong; m = middle; w = weak. Melting points were measured on Stanford Research Systems oder Micro-Hot-Stage GalenTM III Cambridge Instruments. Abbreviation: Mp. The melting points were not corrected. Mass spectra were obtained on a Hewlett-Packard HP GC / MS 5890 / 5972 instrument (EI, 70 eV) by GC inlet, on a MX-1321 and Finnigan MAT 95 XP instruments (EI, 70 eV) by direct inlet. The data are given as mass units per charge (*m/z*). Column chromatography was performed on silica gel (63 – 200 mesh, Merck). Chemical yields refer to pure isolated substances. The CDP-Star chemiluminescent substrate was obtained from Sigma Aldrich while other chemicals used in the assay were of analytical grade.

Alkaline Phosphatase Inhibition Assay.

The diethanolamine (8 M DEA (pH 9.8), 2.5 mM $MgCl_2$ and 0.05 mM $ZnCl_{2)}$ was used as assay buffer. All the compounds were tested at the final concentration of 0.2 mM with the final DMSO 1% (v/v). The total volume of 50 µL contained 10 µL of a tested compound, followed by the addition of 20 µL of TNAP (1:800 times diluted (0.8 units/mL) enzyme in assay buffer). The mixture was pre-incubated for 3-5 minutes at 37 ^{o}C and luminescence was observed as pre-read using microplate reader (BioTek FLx800, Instruments, Inc. USA). Then, 20 µL of CDP-star (final concentration of 110 µM) was added to initiate the reaction and the assay mixture was incubated again for 15 min at 37 ^{o}C. The change in the luminescence was observed as after-read. The activity of each compound was compared with total activity control (without any inhibitor). Levamisole (2 mM per well) was used as a positive control. For potentially active compounds, exhibited over 50% inhibition, full concentration inhibition curves were produced. For this purpose 6 to 8 serial dilutions of each compound (200 µM to 20 nM) were prepared in assay buffer and their dose response curves were obtained by assaying each inhibitor concentration against TALP using the above mentioned reaction conditions. All experiments were repeated three times. The Cheng Prusoff equation was used to calculate the IC_{50} values (Table 3), determined by the non-linear curve fitting program PRISM 5.0 (GraphPad, San Diego, California, USA).

General procedure for the synthesis of 6.

A predried Schlenk tube was purged with inert gas, furnished with a mixture of 2-chloro-5-nitrobenzoyl chloride **5** (1.00 g, 1equiv.), $Pd(PPh_3)_2Cl_2$ (32 mg, 0.01 equiv.), CuI (18 mg, 0.02 equiv.) and closed with a septum stopper. Then extra dry THF (20 ml) and Et_3N (0.82 ml, 1.3 equiv.) were added to the mixture. The Schlenk tube was threefold refilled with inert gas. Then the acetylene (1.3 equiv.) was added dropwise within 10 min with stirring. The reaction mixture was stirred for 6 h at room temperature. After the consumption of the starting material (TLC control) the solvent was evaporated under reduced pressure. In the case of solid character of the residue, the latter was washed with water, filtered and recrystallized from a mixture of *n*-heptane and ethanol (2:1). In case of an oily character of the residue, the crude reaction mixture was diluted with dichloromethane and washed with water. The organic layer was separated and dried over Na_2SO_4, filtered and purified by column chromatography (silica gel, chloroform / heptane, 3:1).

1-(2-Chloro-5-nitrophenyl)-3-*p*-tolylprop-2-yn-1-one (6a).

Brown crystals, yield 76%. Mp 141-143 °C. ^{1}H NMR (300.13 MHz, $CDCl_3$): δ= 2.44 (s, 3H, -C*H*$_3$), 7.27 (d, 2H, ^3J = 8.0 Hz, -Tol), 7.59 (d, 2H, ^3J = 8.0 Hz, -Tol), 7.70 (d, 1H, ^3J = 8.7 Hz, Ar), 8.33 (dd, 1H, ^3J = 8.7 Hz, ^4J = 2.7 Hz, Ar), 8.95 (d, 1H, ^4J = 2.7 Hz, Ar). ^{13}C NMR (300.13 MHz, $CDCl_3$): δ = 21.80 (-CH_3, -Tol) 87.64 (C, -C*C*-Tol), 96.91 (C, -*C*C-Tol), 116.11 (C, Tol), 127.08 (CH, Ar), 127.18 (CH, Ar), 129.62 (2CH, Tol), 132.68 (CH, Ar), 133.40 (2CH, Tol), 136.67 (C 1, Ar), 140.00 (-CO-), 142.55 (C, Tol), 146.25 (C 2, Ar), 174.20 (C 5, Ar). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3108 (w), 2919 (w), 2202 (s), 1602 (s), 1519 (s), 1396 (m), 1342 (s), 1297 (s), 1248 (m), 1176 (m), 1074 (s), 1037 (m), 924 (m), 819 (s), 736 (s), 631 (m), 570 (m), 539 (m). MS (GC, 70eV): *m/z* (%) = 301 (M_1^+, 14), 299 (M_2^+, 41), 271 (25), 189 (18), 143 (100), 115 (10), 89 (9). HRMS (ESI): calcd for $C_{16}H_{10}{}^{35}ClNO_3$ 299.0338, found 299.0344; calcd for $C_{16}H_{10}{}^{37}ClNO_3$ 301.0314, found 301.0312.

1-(2-Chloro-5-nitrophenyl)-3-phenylprop-2-yn-1-one (6b).

Brown crystals, yield 65%. Mp 110-112 °C. ^{1}H NMR (300.13 MHz, $CDCl_3$): δ= 7.34-7.48 (m, 2H, Ph), 7.49-7.57 (m, 1H, Ph), 7.64-7.70 (m, 2H, Ph + 1H, Ar), 8.32 (dd, 1H, ^3J = 8.8 Hz, ^4J = 2.7 Hz, Ar), 8.93 (d, 1H, ^4J = 2.7 Hz, Ar). ^{13}C NMR (250.13 MHz, $CDCl_3$): δ = 87.62 (C, -C*C*-

Ph), 96.12 (C, -*C*C-Ph), 119.28 (C, Ph), 127.23, 127.27 (2CH, Ar), 128.85 (2CH, Ph), 131.60 (CH, Ph), 132.77 (CH, Ar), 133.38 (2CH, Ph), 136.58 (C 1, Ar), 140.11 (-CO-), 146.32 (C 2, Ar), 174.24 (C 5, Ar). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3107 (s), 2189 (m), 1651 (w), 1604 (m), 1573 (m), 1521 (m), 1486 (m), 1440(m), 1349 (w), 1309 (w), 1270 (m), 1251 (m), 1198 (m), 1107 (m), 1077 (w), 997 (w), 897 (w), 839 (w), 810 (m), 761 (w), 735 (w), 688 (w), 627 (w), 594 (w), 537(w). MS (GC, 70eV): *m/z* (%) = 286 (M^+, 29), 257 (26), 176 (21), 129 (100), 75 (21). HRMS (ESI): calcd for $C_{15}H_8ClNO_3$ 286.0266, found 286.0267.

1-(2-Chloro-5-nitrophenyl)hept-2-yn-1-one (6c).

Yellow oil, yield 75%. ^{1}H NMR (300,13 MHz, $CDCl_3$): δ= 0.95 (t, 3H, ^3J = 7.3 Hz, -$C_3H_6C\mathit{H}_3$), 1.42-1.56 (m, 2H, -$CH_2CH_2C\mathit{H}_2CH_3$), 1.59-1.72 (m, 2H, -$CH_2C\mathit{H}_2$-$CH_2CH_3$), 2.51 (t, 2H, ^3J = 7.0 Hz, -$C\mathit{H}_2C_3H_7$), 7.64 (d, 1H, ^3J = 8.8 Hz, Ar), 8.27 (dd, 1H, ^3J = 8.8 Hz, ^4J = 2.7 Hz, Ar), 8.84 (d, 1H, ^4J = 2.7 Hz, Ar). ^{13}C NMR (300.13 MHz, $CDCl_3$): δ = 13.40 (-CH_3, -*n*-But), 19.00, 22.01, 29.42 ($3CH_2$), 80.33 (C, -C*C*-*n*-Bu), 100.16 (C, -*C*C-*n*-Bu), 126.99, 127.33, 132.65 (3CH, Ar), 136.51 (C 1, Ar), 139.94 (-CO-), 146.14 (C 2, Ar), 174.35 (C 5, Ar). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 2958 (m), 2871 (w), 2209 (m), 1660 (m), 1606 (m), 1524 (s), 1460 (m), 1344 (s), 1231 (s), 1053 (m), 914 (m), 835 (m), 738 (s), 533 (m). MS (GC, 70eV): *m/z* (%) = 265 (M^+, 1), 225 (23), 224 (11), 223 (71), 186 (33), 185 (12), 184 (100), 178 (11), 148 (15), 140 (10), 138 (28), 113 (21), 110 (29), 109 (70), 81 (32), 79 (47), 75 (26), 74 (16), 66 (22), 63 (14), 53 (30), 43 (33), 41 (42), 39 (19). HRMS (ESI): calcd for $C_{13}H_{12}ClNO_3$ 265.0500, found 265.0506.

1-(2-Chloro-5-nitrophenyl)oct-2-yn-1-one (6d).

Yellow oil, yield 78%. ^{1}H NMR (300,13 MHz, $CDCl_3$): δ= 0.94 (t, 3H, ^3J = 7.2 Hz, -$(CH_2)_4C\mathit{H}_3$), 1.34-1.50 (m, 4H, -$(CH_2)_2$ $(C\mathit{H}_2)_2CH_3$), 1.70 (p, 2H, ^3J = 7.2 Hz, -$CH_2C\mathit{H}_2C_3H_7$, 2.54 (t, 2H, ^3J = 7.1 Hz, -$C\mathit{H}_2C_4H_9$), 7.67 (d, 1H, ^3J = 8.8 Hz, Ar), 8.30 (dd, 1H, ^3J = 8.8 Hz, ^4J = 2.7 Hz, Ar), 8.87 (d, 1H, ^4J = 2.7 Hz, Ar). ^{13}C NMR (250.13 MHz, $CDCl_3$): δ = 13.79 (-C_4H_8-*C*H_3), 19.29, 22.04, 27.12, 31.03 ($4CH_2$), 80.34 (C, -COC*C*-), 100.22 (C, -CO*C*C-), 127.00, 127.33, 132.65 (3CH), 136.52 (C 1, Ar), 139.95 (-CO-), 146.14 (C 2, Ar), 174.36 (C 5, Ar). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 2930 (m), 2209 (s), 1660 (s), 1605 (s), 1525 (s), 1459 (m), 1344 (s), 1230 (s), 1130 (m), 1051 (s), 839 (m), 738(s), 534 (m). MS (GC, 70eV): *m/z* (%) = 279 (M^+, 2), 264 (12), 262 (11), 244 (16), 236 (10), 223 (16), 198 (12), 186 (36), 184 (100), 178 (10), 148 (13), 140 (12), 138 (31), 123 (14), 113 (19), 110 (21), 95 (55), 80 (19), 79 (16), 75 (19), 74 (12), 67 (34),

66 (18), 63 (10), 55 (40), 53 (14), 41 (36), 39 (15), 29 (28). HRMS (ESI-TOF): calcd for $C_{14}H_{14}ClNO_3$ 279.0656, found 279.0662.

General procedure for the synthesis of 7.

Under a constant flow of an inert gas a pressure tube was charged with a magnetic stirrer, appropriate α,β-ynone **6** (450 mg, 1 equiv.), K_2CO_3 (for aliphatic amines) or K_3PO_4 (for aromatic amines) (2 equiv.), extra dry dimethylformamide (6 ml) and appropriate amine (1.7 equiv.). After the consumption of the starting material (6-10 h; TLC control) at 120 °C the reaction mixture was cooled to room temperature. The solvent was evaporated and the residue was recrystallized from an *i*-PrOH or purified by a column chromatography (silica gel, heptane / ethyl acetate (5:1 to 1:1); Rf ≈ 0.30-0.45).

1-(3,4-Dimethoxyphenethyl)-6-nitro-2-*p*-tolylquinolin-4(1*H*)-one (7aa).

Brown crystals. 51%. Mp 163-165 °C. ^{1}H NMR (300,13 MHz DMSO-d_6): δ= 2.43 (s, 3H, -C*H*$_3$, -Tol), 2.84 (t, 2H, ^3J = 7.2 Hz, -CH_2-C*H*$_2$-Ar`), 3.59 (s, 3H, -OC*H*$_3$), 3.73 (s, 3H, -OC*H*$_3$), 4.37 (t, 2H, $^3J$ = 7.2 Hz, -C*H*$_2$-$CH_2$Ar`), 6.07 (s, 1H, COC*H*=), 6.27 (d, 1H, ^4J = 1.9 Hz, Ar`), 6.39 (dd, 1H, $^3J$ = 8.1 Hz, $^4J$ = 1.9 Hz, Ar`), 6.79 (d, 1H, ^3J = 8.1 Hz, Ar`), 7.28 (d, 2H, ^3J = 7.9 Hz, -Tol), 7.34 (d, 2H, ^3J = 7.9 Hz, -Tol), 8.28 (d, 1H, ^3J = 9.5 Hz, Ar), 8.56 (dd, 1H, ^3J = 9.5 Hz, ^4J = 2.9 Hz, Ar), 9.00 (d, 1H, ^4J = 2.9 Hz, Ar). ^{13}C NMR (250.13 MHz, DMSO-d_6): δ = 20.83 (CH_3, -Tol), 33.43, 49.84 ($2CH_2$), 55.07, 55.56 (2 -OCH_3), 111.77, 112.06, 113.08 (3CH), 120.07 (C), 120.66, 121.70 (2CH), 126.01 (C), 126.16 (CH),128.24, 129.12 (4CH, -Tol), 129.34, 132.10, 139.28, 142.65 (4C), 144.11 (CH), 147.65, 148.64, 156.05, 174.93 (4C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3087 (w), 2952 (w), 1637 (s), 1519 (s), 1470 (s), 1334 (s), 1265 (m), 1148 (m), 1033 (m), 832 (m), 746 (m), 626 (w). MS (GC, 70eV): *m/z* (%) = 444 (M^+, 17), 443 (13), 427 (91), 414 (39), 398 (12), 293 (32), 263 (23), 247 (36), 177 (21), 165 (11), 151 (100), 131 (27), 107 (14). HRMS (ESI): calcd for $C_{26}H_{24}N_2O_5$ 444.1679, found 444.1685.

1-(4-Methoxybenzyl)-6-nitro-2-*p*-tolylquinolin-4(1*H*)-one (7ab).

Yellow crystals, yield 83%. Mp 245-247 °C. ^{1}H NMR (300,13 MHz, $CDCl_3$): δ= 2.39 (s, 3H, C*H*$_3$, -Tol), 3.77 (s, 3H, -OC*H*$_3$), 5.27 (s, 2H, -C*H*$_2$-), 6.36 (s, 1H, -COC*H*-), 6.83 (d, 2H, ^3J = 8.8 Hz, Ar`), 6.91 (d, 2H, $^3J$ = 8.8 Hz, Ar`), 7.21 (d, 2H, ^3J = 8.3 Hz, -Tol), 7.25 (d, 2H, ^3J = 8.3 Hz, -Tol + C*D*Cl_3), 7.45 (d, 1H, ^3J = 9.4 Hz, Ar), 8.27 (dd, 1H, ^3J = 9.4 Hz, ^4J = 2.8 Hz, Ar), 9.28 (d,

1H, ^4J = 2.8 Hz, Ar). ^{13}C NMR (250.13 MHz, DMSO-d_6): δ = 21.29 (-CH_3, -Tol), 52.22 (-CH_2-), 55.26 (-OCH_3), 114.43 (CH), 114.64 (2CH), 118.89, 123.28, 126.13 (3CH), 126.56 (2CH), 126.84, 127.06 (2C), 127.89, 129.53 (4CH), 131.81, 140.38, 143.27, 144.59, 156.35, 159.25, 176.55 (7C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 2951 (w), 1634 (s), 1515 (s), 1472 (s), 1332 (s), 1253 (s), 1171 (m), 1114 (m), 1027 (m), 911 (m), 801 (s), 744 (m), 634 (m). MS (GC, 70eV): *m/z* (%) = 400 (M^+, 5), 122 (40), 121 (100), 77 (11). HRMS (ESI): calcd for $C_{24}H_{20}N_2O_4$ 400.1417, found 400.1423.

(*R*)-6-Nitro-1-(1-phenylethyl)-2-*p*-tolylquinolin-4(1*H*)-one (7ac).

Beige crystals, yield 87%. Decompose near to 365 °C. ^{1}H NMR (500,13 MHz DMSO-d_6): δ= 2.01 (d, 3H, ^3J = 7.0 Hz, -CHC*H*$_3$Ph), 2.39 (s, 3H, CH_3, -Tol), 5.74 (q, 1H, ^3J = 7.0 Hz, -C*H*CH_3Ph), 6.19 (s, 1H, -COC*H*=), 7.31-7.41 (m, 3H, Ar` + 4H, -Tol), 7.47 (d, 1H, $^3J$ = 9.6 Hz, Ar), 7.57 (d, 2H, $^3J$ = 5.8 Hz, Ar`), 8.20 (dd, 1H, ^3J = 9.6 Hz, ^4J = 2.9 Hz, Ar), 8.95 (d, 1H, ^4J = 2.9 Hz, Ar). ^{13}C NMR (500.13 MHz, DMSO-d_6): δ = 16.89, 20.81 (2CH_3), 58.77 (CH, -CHMePh), 113.38 (CH, -COCH-), 121.65, 121.73, 124.96 (3CH), 125.34 (2CH), 127.18 (C), 127.45 (2CH), 129.07 (3CH), 129.60 (2CH), 132.64, 139.22, 139.61, 142.31, 142.85, 156.79, 174.96 (7C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3084 (w), 1633 (s), 1513 (m), 1471 (s), 1331 (s), 1238 (m), 1085 (m), 911 (m), 864 (s), 835 (s), 749 (s), 695 (s), 652 (m). MS (GC, 70eV): *m/z* (%) = 384 (M^+, 2), 280 (15), 105 (100). HRMS (ESI): calcd for $C_{24}H_{20}N_2O_3$ 384.1468, found 384.1461.

1-Heptyl-6-nitro-2-*p*-tolylquinolin-4(1*H*)-one (7ad).

Brown crystals. 72%. Mp 133-135 °C. ^{1}H NMR (300,13 MHz, DMSO-d_6): δ= 0.83 (t, 3H, ^3J = 7.0 Hz, -$(CH_2)_6$C*H*$_3$), 1.12 (m, 8H, - $(CH_2)_2$(C*H*$_2$)$_4$$CH_3$), 1.60 (p, 2H, ^3J = 6.5 Hz, -CH_2C*H*$_2$$C_5H_{11}$), 2.45 (s, 3H, -C*H*$_3$, -Tol), 4.15 (t, 2H, ^3J = 7.9 Hz, -C*H*$_2$$C_6H_{13}$), 6.12 (s, 1H, -COC*H*=), 7.42 (d, 2H, ^3J = 7.45 Hz, -Tol), 7.49 (d, 2H, ^3J = 7.45 Hz, -Tol), 8.13 (d, 1H, ^3J = 9.5 Hz, Ar), 8.53 (dd, 1H, ^3J = 9.5 Hz, ^4J = 2.9 Hz, Ar), 8.98 (d, 1H, ^4J = 2.9 Hz, Ar). ^{13}C NMR (250.13 MHz, DMSO-d_6): δ = 13.73, 20.84 (2CH_3), 21.86, 25.42 (2CH_2), 27.62 (2CH_2) , 30.75, 48.04 (2CH_2), 113.10, 119.78, 121.70 (3CH), 125.97 (C), 126.14 (CH), 128.21, 129.23 (4CH, Tol), 132.14, 139.33, 142.58, 144.08, 155.90, 174.88 (6C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3058 (w), 2917 (w), 1640 (s), 1509 (m), 1465 (s), 1329 (s), 1192 (m), 1111 (m), 1057 (m), 909 (m), 835 (m), 797 (m), 745 (m), 653 (m). MS (GC, 70eV): *m/z* (%) = 378 (M^+, 57), 377 (55), 363 (12), 349 (15), 293 (100), 287 (20), 280 (73), 247 (57), 204 (15), 177 (24), 131 (26), 57 (14), 43 (20), 41 (23), 29 (16). HRMS (ESI): calcd for $C_{23}H_{26}N_2O_3$ 378.1937, found 378.1943.

1-Hexyl-6-nitro-2-*p*-tolylquinolin-4(1*H*)-one (7ae).

Brown crystals, yield 55%. Mp 160-162 °C. ^{1}H NMR (300,13 MHz, $CDCl_3$: DMSO-d_6 6:1): δ= 0.76 (s, 3H, -C_5H_{10}-C*H*$_3$), 1.01-1.17 (m, 6H, -$(CH_2)_2$-(C*H*$_2$)$_3$-CH_3), 1.62 (p, ^{3}J = 7.0 Hz, 2H, -CH_2-C*H*$_2$-C_4H_9), 2.42 (s, 3H, -C*H*$_3$, -Tol), 4.08 (t, ^{3}J = 7.9 Hz, 2H, -C*H*$_2$-C_5H_{11}), 6.14 (s, 1H, -COC*H*=), 7.31 (d, ^{3}J = 1.7 Hz, 4H, -Tol), 7.80 (d, 1H, ^{3}J = 9.5 Hz, Ar), 8.45 (dd, 1H, ^{3}J = 9.5 Hz, ^{4}J = 2.8 Hz, Ar), 9.11 (s, 1H, ^{4}J = 2.8 Hz, Ar). ^{13}C NMR (250.13 MHz, DMSO-d_6): δ = 13.69, 20.86 (2CH_3), 21.69, 25.18, 27.66, 30.22, 48.08 (5CH_2), 113.12, 119.76, 121.70 (3CH), 125.96 (C), 126.12 (CH), 128.21, 129.25 (4CH, -Tol), 132.15, 139.36, 142.56, 144.07, 155.89, 174.87 (6C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3077, 2918, 2855, 1640, 1508, 1466, 1240, 854, 833, 798, 745. MS (GC, 70eV): *m/z* (%) = 364 (M^+, 89), 293 (100), 280 (28), 248 (13), 247 (58), 234 (10), 204 (14), 177 (24), 131 (20), 43 (29), 41 (18), 29 (10). HRMS (ESI): calcd for $C_{22}H_{25}N_2O_3$ 364.1782, found 364.1787.

6-Nitro-1-cyclohexyl-2-*p*-tolyl-4-quinolone (7af).

Yellow crystals, yield 60%. Mp 260-262 °C. ^{1}H NMR (300 MHz, $CDCl_3$) δ = 0.9 – 1.29 (m, 4H, Cyclohexyl), 1.81 (t, *J* = 12.6 Hz, 4H, Cyclohexyl), 2.28 (qd, *J* = 12.7, 3.7 Hz, 2H, Cyclohexyl), 2.39 (s, 3H, -C*H*$_3$, -Tol), 4.17 (tt, *J* = 12.7, 3.7 Hz, 1H, Cyclohexyl), 6.17 (s, 1H, -COC*H*=), 7.2 – 7.26 (m, 4H, Tolyl + $CDCl_3$), 7.98 (d, ^{3}J = 9.6 Hz, 1H), 8.3 (dd, $^{3,4}J$ = 9.6, 2.9 Hz, Ar), 9.2 (d, 1H, ^{4}J = 2.9 Hz, Ar). ^{13}C NMR (300 MHz, $CDCl_3$) δ = 21.43 (CH_3), 24.98, 25.65, 26.35, 30.97, 33.96 (5 CH_2), 63.93, 114.87, 120.02, 123.58, 124.84 (5CH), 127.40 (C), 127.80, 129.70 (4CH), 133.42, 140.04, 142.80, 144.60, 157.09, 176.29 (6C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 2927 (m), 2853 (m), 1607 (m), 1557 (s), 1519 (m), 1499 (m), 1446 (w), 1309 (s), 1254 (s), 1207 (m), 1182 (m), 1141 (m), 1106 (s), 1034 (m), 821 (m), 792 (m), 748 (m), 678 (m), 653 (m). MS (GC, 70eV): *m/z* (%) = 362 (M^+, 31), 281 (31), 280 (100), 234 911), 204 (12), 190 (10), 83 (18), 55 (50), 41 (26). HRMS (EI): calcd for $C_{22}H_{22}N_2O_3$ 362.1624, found 362.1630.

6-Nitro-1-pentyl-2-*p*-tolylquinolin-4(1*H*)-one (7ag).

Pale yellow crystals, yield 71%. Mp 164-166 °C. ^{1}H NMR (250,13 MHz, DMSO-d_6): δ= 0.74 (s, 3H, -C_4H_8-C*H*$_3$), 1.07 (s, 4H, -C_2H_4-(C*H*$_2$)$_2$-CH_3), 1.61 (s, 2H, -CH_2-C*H*$_2$-C_3H_7), 2.44 (s, 3H, -Tol), 4.12 (s, 2H, -C*H*$_2$-C_4H_9), 6.08 (s, 1H, -COC*H*=), 7.41 (d, 2H, ^{3}J = 7.2 Hz, -Tol), 7.47 (d, 2H, ^{3}J = 7.2 Hz, -Tol), 8.09 (d, 1H, ^{3}J = 8.4 Hz, Ar), 8.49 (d, 1H, ^{3}J = 8.4 Hz, Ar), 8.91 (s, 1H, Ar). ^{13}C NMR (250.13 MHz, DMSO-d_6): δ = 13.54, 20.86 (2CH_3), 21.26, 27.51, 27.72, 48.17

($4CH_2$), 113.14, 119.75, 121.69 (3CH), 125.96 (C), 126.12 (CH), 128.18, 129.25 (4CH, -Tol), 132.16, 139.37, 142.56, 144.06, 155.90, 174.86 (6C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 2912 (w), 1634 (s), 1464 (s), 1329 (s), 1109 (m), 1056 (m), 911 (m), 832 (s), 745 (s), 652 (m). MS (GC, 70eV): *m/z* (%) = 351 (M^{+1}, 21), 350 (M^{+}, 100), 349 (M^{-1}, 14),295 (10), 294 (19), 293 (98), 248 (10), 247 (45), 204 (14), 177 (22), 131 (21), 43 (20), 41 (11). HRMS (EI): calcd for $C_{21}H_{22}N_2O_3$ 350.1625, found 350.1625.

1-*n*-Butyl-6-nitro-2-*p*-tolyl-4-quinolone (7ah).

Light brown powder, yield 79%. Mp 192-194 °C. ^{1}H NMR (250.13 MHz, DMSO): δ = 0.69 (t, 3H, ^{3}J = 7.0 Hz, -C_3H_6-C*H*$_3$,), 1.11 (m, 2H, $CH_3CH_2CH_2CH_2$-), 1.6 (s, 2H, $CH_3CH_2CH_2CH_2$-), 2.44 (s, 3H, -C*H*$_3$, -Tol), 4.14 (s, 2H, $CH_3CH_2CH_2CH_2$-), 6.09 (s, 1H, -COC*H*=), 7.45 (dd, 4H, -Tol, ^{3}J = 7.3 Hz), 8.1 (d, 1H, ^{3}J = 8.5 Hz, Ar), 8.5 (d, 1H, ^{3}J = 8.5 Hz, Ar), 8.93 (s, 1H, Ar). ^{13}C NMR (75.47 MHz, DMSO): δ = 13.11, 18.92 ($2CH_3$), 20.86, 29.95, 47.96 ($3CH_2$), 113.13, 119.74, 121.67 (3CH), 125.94 (C) 126.01 (CH), 128.20, 129.25 ($4CH_{Ar}$), 132.15, 139.36, 142.52, 144.05, 155.89, 174.85 (6C). IR (ATR): $\tilde{\nu}$ = 1638 (m), 1625 (m), 1606 (s), 1582 (m), 1508 (w), 1472 (s), 1394 (w), 1329 (s), 1251 (w), 1206 (m), 1172 (m), 1147 (w), 1135 (m), 1107 (w), 1014 (w), 975 (w), 931 (w), 911 (w), 838 (s), 825 (s), 798 (s), 767 (w), 747 (s), 730 (w), 701 (w). 672 (w), 654 (m), 628 (w), 579 (w), 537 (w). MS (GS): m/z (%) = 336 (M^{-1}, 100), 294 (19), 293 (98), 247 (44), 204 (15), 190 (10), 177 (20), 131 (20), 76 (10), 41 (13), 29 (14). HRMS (ESI): calcd for C20H21N2O3: 337.15467; found: 337.15457.

6-Nitro-1-*n*-propyl-2-*p*-tolyl-4-quinolone (7ai).

Light brown powder, yield 87%. Mp 117-118 °C. ^{1}H NMR (250.13 MHz, DMSO): δ = 0.69 (t, 3H, Ar-CH_3, ^{3}J = 7.1 Hz), 1,65 (d, 2H, $CH_3CH_2CH_2$-, ^{3}J = 7.1 Hz), 2.45 (s, 3H, C*H*$_3CH_2CH_2$-), 4.08-4.13 (m, 2H, $CH_3CH_2CH_2$-), 6.11 (s, 1H, -COCH=), 7.45 (dd, 4H, -Tol, ^{3}J = 7.6 Hz), 8.13 (d, 1H, 8-H, ^{3}J = 8.4 Hz), 8.52 (d, 1H, 7-H, ^{3}J = 8.4 Hz), 8.97 (d, 1H, 5-H, ^{4}J = 2.0 Hz). ^{13}C NMR (75.47 MHz, DMSO): δ = 10.51, 20.89 ($2CH_3$), 21.42, 49.69 ($2CH_2$), 113.11, 119.86, 121.70 (3CH), 125.97 (C), 126.10 (CH), 128.18, 129.31 (4CH), 132.23, 139.39, 142.60, 144.09, 156.03, 174.88 (C). IR (ATR): $\tilde{\nu}$ = 2972 (w), 1626 (s), 1605 (s), 1575 (m), 1509 (m), 1470 (s), 1390 (m), 1332 (s), 1293 (s), 1222 (w), 1179 (m), 1138 (m), 1106 (m), 1056 (m), 1014 (w), 964 (w), 924 (m), 914 (w), 847 (m), 824 (s), 798 (s), 746 (s), 700 (w), 672 (w), 653 (m), 576 (w), 542 (m). MS (GS): m/z (%) = 322 (M^{-1}, 100), 294 (22), 293 (97), 248 (10), 247 (50), 204 (16), 190 (12), 177 (22), 131 (20), 76 (10), 41 (10). HRMS (ESI): calcd for $C_{19}H_{19}N_2O_3$: 323.13902; found: 323.13931.

1-*iso*-Propyl-6-nitro-2-*p*-tolyl-4-quinolone (7aj).

Yellow powder, yield 82%. Mp 280-282 °C. ^{1}H NMR (250.13 MHz, $CDCl_3$): δ = 1.61 (s, 3H, CH_3), 1.63 (s, 3H, CH_3), 2.44 (s, 3H, Ar-CH_3), 4.69-4.84 (m, 1H, Alk-CH), 6.23 (s, 1H, -COCH=), 7.27-7.34 (m, 4H, -Tol), 7.91 (d, ^{3}J = 9.6 Hz, 1H, 8-H), 8.37 (dd, $^{3,4}J$ = 9.6, 2.8 Hz, 1H, 7-H), 9.25 (d, ^{4}J = 2.8 Hz, 1H, 5-H). ^{13}C NMR (75.47 MHz, $CDCl_3$): δ = 21.30 (2CH_3, -Alk), 21.36 (CH_3, -Tol), 54.21 (CH, Alk), 114.55, 119.68, 123.70, 125.07 (4CH), 127.50 (2CH), 127.76 (C), 129.80 (2CH), 133.17, 140.14, 142.93, 143.76, 156.92, 176.12 (6C). IR (ATR): $\tilde{\nu}$ = 3146 (w), 1633 (m), 1603 (s), 1506 (w), 1455 (m), 1405 (w), 1375 (w), 1332 (s), 1288 (s), 1247 (w), 1161 (m), 1136 (m), 1093 (w), 1055 (m), 1022 (w), 997 (w), 928 (w), 911 (w), 847 (s), 820 (s), 793 (m), 776 (w), 747 (s), 726 (w), 695 (w), 644 (m), 544 (w). MS (GS): m/z (%) = 322 (M^{-1}, 72), 323 (16), 281 (19), 280 (100), 252 (14), 234 (38), 206 (12), 205 (13), 204 (17), 191 (18), 190 (17), 115 (10), 43 (30), 41 (16). HRMS (ESI): calcd for $C_{19}H_{19}N_2O_3$: 323.1390; found: 323.1396.

6-Nitro-1-phenyl-2-*p*-tolyl-4-quinolone (7ak).

Brown powder, yield 64%. Mp 337-338 °C. ^{1}H NMR (300.13 MHz, CF3COOD, DMSO): δ = 1.95 (s, 3H, CH_3), 6.84 (dd, ^{3}J = 8.4 Hz, 4H, Ar), 6.91-7.07 (m, 2H, Ar), 7.09-7.36 (m, 5H, Ar), 8.30 (dd, $^{3,4}J$ = 9.7 Hz, 2.5 Hz, 1H, Ar), 9.12 (d, ^{4}J = 2.5 Hz, 1H, Ar). ^{13}C NMR (75.47 MHz, CF_3COOD, DMSO-d_6): δ = 23.25 (-CH_3, -Tol) 113.00 (CH), 123.55 (C), 124.30, 125.56 (2CH), 131.51 (2CH), 131.85 (CH), 132.21, 132.60 (4CH), 132.79 (C), 133.70 (2CH), 134.57 (CH), 140.40, 145.77, 147.88, 149.47, 167.42, 173.74 (6C). IR (ATR): $\tilde{\nu}$ = 3058 (w), 2334 (w), 2139 (w), 1639 (s), 1608 (s), 1508 (s), 1492 (s), 1462 (s), 1379 (s), 1332 (s), 1252 (m), 1194 (m), 1157 (w), 1146 (m), 1114 (m), 1061 (m), 1026 (m), 970 (w), 929 (w), 908 (m), 859 (s), 829 (s), 794 (s), 781 (s), 744 (s), 725 (s), 702 (s), 662 (m), 634 (m), 585 (w), 540 (s). MS (GS): m/z (%) = 356 (M^{+}, 41), 328 (13), 278 (46), 277 (100), 201 (14), 199 (15), 183 (12), 119 (10), 93 (10), 77 (19), 43 (11). HRMS (ESI): m/z [M+H]+ calcd for $C_{22}H_{16}O_3N_2$: 356.1155; found: 356.1154.

6-Nitro-2-*p*-tolyl-2,4,6-trimethylphenyl-4-quinolone (7al).

Brown powder, yield 65%. Mp 234-236 °C. ^{1}H NMR (250.13 MHz, $CDCl_3$): δ = 1.90 (s, 6H, CH_3-Ar), 2.28 (s, 3H, *o*-CH_3-Ar), 2.30 (s, 3H, *o*-CH_3-Ar), 6.53 (s, 1H, -COCH=), 6.81 (d, ^{3}J = 9.4 Hz, 1H, 8-H), 6.89 (s, 2H, Ar), 7.07 – 6.97 (m, 4H, Ar), 8.23 (dd, $^{3,4}J$ = 9.4, 2.7 Hz, 1H, 7-H), 9.34 (d, J = 2.7 Hz, 1H, 5-H). ^{13}C NMR (75.47 MHz, $CDCl_3$): δ = 17.84 (2CH_3), 21.09, 21.27 (2CH_3), 114.46, 118.48, 123.41 (3CH), 125.72 (C), 126.47 (CH), 128.12, 128.71, 130.03 (6CH), 131.39, 133.91 (2C), 135.79 (2C), 139.78, 139.98, 143.74, 144.64, 155.34, 176.95 (6C).

IR (ATR): $\tilde{\nu}$ = 2921 (w), 1634 (s), 1608 (s), 1556 (w), 1505 (m), 1455 (w), 1372 (m), 1330 (s), 1294 (m), 1261 (m), 1245 (m), 1210 (m), 1184 (m), 1146 (w), 1129 (w), 1116 (w), 1060 (w), 1034 (w), 1017 (w), 971 (w), 938 (m), 906 (w), 852 (m), 831 (m), 817 (s), 793 (m), 747 (s), 723 (m), 671 (w), 648 (m), 632 (w), 563 (m). MS (GS): m/z (%) = 398 (M^+, 100), 399 (27), 370 (24), 352 (11). HRMS (ESI): calcd for $C_{25}H_{22}O_3N_2$ 398.1625; found: 398.1625.

1-(3,5-Dimethylphenyl)-6-nitro-2-*p*-tolylquinolin-4(1*H*)-one (7am).

Yellow crystals, yield 61%. Mp 303-307 °C. ^{1}H NMR (300,13 MHz DMSO-d_6): δ= 2.27 (s, 9H, $3CH_3$), 6.44 (s, 1H, -COC*H*=), 6.77 (s, 2H, Ar`), 6.96-7.09 (m, 1H, Ar+1H, Ar`+4H, -Tol), 8.21 (dd, 1H, ^3J = 9.4 Hz, ^4J = 2.7 Hz, Ar), 9.30 (d, 1H, ^4J = 2.7 Hz, Ar). ^{13}C NMR (250.13 MHz, DMSO-d_6): δ = 21.08 ($2CH_3$, Ar`), 21.21 (CH_3,-Tol), 113.81, 119.74, 122.98 (3CH), 125.51 (C), 125.71 (CH), 127.04, 128.62, 128.86 (6CH), 131.06 (CH, -Tol), 131.96, 138.27, 139.10 (3C), 139.87 (2C), 143.37, 145.88, 155.35, 176.85 (4C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3080 (w), 2918 (w), 1640 (s), 1608 (s), 1510(s), 1511 (m), 1462 (s), 1332 (s), 1188 (m), 1188 (m), 1118 (m), 1063 (m), 928 (m), 826 (s), 745 (s), 709 (m), 667 (m), 602 (m), 532 (s). MS (GC, 70eV): *m/z* (%) = 385 (M^{+1}, 27), 384 (M^+, 100), 356 (29), 338 (16), 295 (13). HRMS (ESI): calcd for $C_{24}H_{20}N_2O_3$ 384.1468, found 384.1476.

1-(2,3-Dihydro-1*H*-inden-5-yl)-6-nitro-2-*p*-tolylquinolin-4(1*H*)-one (7an).

Yellow crystals, yield 62%. Mp 261-263 °C. ^{1}H NMR (500,13 MHz $CDCl_3$: DMSO-d_6 9:1): δ= 1.96-2.08 (m, 2H, -$CH_2CH_2CH_2$-), 2.24 (s, 3H, -C*H*$_3$, -Tol), 2.74-2.90 (m, 4H, -$CH_2CH_2CH_2$-), 6.32 (s, 1H, -COC*H*=), 6.91 (d, 1H, ^3J = 7.8 Hz, Ar`), 6.98-7.07 (m, 1H, Ar` + 4H, -Tol + 1H, Ar + $CDCl_3$), 7.20 (d, 1H, ^3J = 7.8 Hz, Ar`), 8.17 (dd, 1H, ^3J = 9.5 Hz, ^4J = 2.7 Hz, Ar), 9.15 (d, 1H, ^4J = 2.7 Hz, Ar). ^{13}C NMR (500,13 MHz $CDCl_3$: DMSO-d_6 9:1): δ = 20.63 (CH_3), 24.75, 31.87, 32.05 ($3CH_2$), 112.94, 119.58, 121.90 (3CH), 124.64 (C), 124.84, 124.89, 125.08, 126.61 (4CH), 128.11 (2CH, -Tol), 128.31 (2CH, -Tol), 131.44, 135.78, 138.40, 142.62, 145.24, 145.63, 145.77, 155.16, 175.97 (9C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3044 (w), 2917 (w), 1608 (s), 1456 (s), 1333 (s), 1129 (m), 1060 (m), 911 (m), 825 (s), 745 (m), 568 (m). MS (GC, 70eV): *m/z* (%) = 397 (M^{+1}, 27), 396 (M^+, 100), 368 (24), 350 (13), 115 (13). HRMS (ESI): calcd for $C_{25}H_{20}N_2O_3$ 396.1468, found 396.1474.

1-(3-Methoxyphenyl)-6-nitro-2-*p*-tolylquinolin-4(1*H*)-one (7ao).

Brown crystals, yield 55%. Mp 272-274 °C. ^{1}H NMR (300,13 MHz $CDCl_3$: DMSO-d_6 6:1): δ= 2.25 (s, 3H, -C*H*$_3$, -Tol), 3.70 (s, 3H, -OC*H*$_3$), 6.32 (s, 1H, -COC*H*=), 6.74 (s, 1H, Ar`), 6.81 (d, 1H, $^{3}J$ = 8.1 Hz, Ar`), 6.90 (dd, 1H, ^{3}J = 8.1 Hz, ^{4}J = 1.7 Hz, Ar`), 6.98-7.03 (m, 2H, -Tol), 7.09 (d, 2H, $^{3}J$ = 7.9 Hz, -Tol + 1H, Ar), 7.30 (t, 1H, $^{3}J$ = 8.1 Hz, Ar`), 8.23 (dd, 1H, ^{3}J = 9.4 Hz, ^{4}J = 2.6 Hz, Ar), 9.13 (d, 1H, ^{4}J = 2.6 Hz, Ar). ^{13}C NMR (300,13 MHz $CDCl_3$: DMSO-d_6 6:1): δ= 20.64 (-CH_3, -Tol), 55.02 (-OCH_3), 112.88, 114.72, 114.81, 119.47, 121.14, 121.81 (6CH), 124.80 (C), 125.31 (CH), 128.15, 128.25 (4CH, -Tol), 130.08 (CH), 131.29, 138.48, 138.70, 142.71, 145.26, 154.80, 160.03, 175.85 (8C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3055 (w), 1600 (s), 1470 (s), 1333 (s), 1177 (m), 1050 (m), 914 (w), 829 (s), 790 (s), 745 (m), 691 (s), 584 (w), 535 (m). MS (GC, 70eV): *m/z* (%) = 387 (M^{+1}, 49), 386 (M^{+}, 100), 385 (M^{-1}, 10), 358 (44), 356 (28), 340 (23), 312 (12). HRMS (EIHR): calcd for $C_{23}H_{18}N_2O_4$ 386.1261, found 386.1261.

1-(4-Methoxyphenyl)-6-nitro-2-*p*-tolylquinolin-4(1*H*)-one (7ap).

Brown crystals. 71%. Mp 252-254 °C. ^{1}H NMR (300,13 MHz, $CDCl_3$/DMSO-d_6 8:1): δ= 2.01 (s, 3H, -C*H*$_3$, -Tol), 3.55 (s, 3H, -OC*H*$_3$), 6.11 (s, 1H, -COC*H*=), 6.78 (m, 9H, Ar), 7.95 (dd, 1H, ^{3}J = 9.5 Hz, ^{4}J = 2.8 Hz, Ar), 8.93 (d, 1H, ^{4}J = 2.7 Hz, Ar). ^{13}C NMR (300,13 MHz, $CDCl_3$/DMSO-d_6 8:1): δ = 20.54, 54.86 (2 CH_3), 112.91 (CH), 114.38 (2CH), 119.20, 121.94 (2 CH), 124.38 (C), 125.06 (CH), 128.11, 128.21, 129.88 (6CH), 130.24, 131.29, 138.38, 142.58, 145.64, 155.19, 159.14, 175.96. IR (ATR, cm^{-1}): $\tilde{\nu}$ = 2917 (w), 1633 (s), 1506 (s), 1462 (s), 1326 (s), 1246 (s), 1182 (m), 1025 (m), 825 (s), 746 (m), 532 (m). MS (GC, 70eV): *m/z* (%) = 387 (M^{+1}, 55), 386 (M^{+}, 100), 358 (39), 356 (23), 340 (24), 312 (11). HRMS (EIHR): calcd for $C_{23}H_{18}N_2O_4$ 386.1261, found 386.1263.

6-Nitro-1-(3-bromphenyl)-2-*p*-tolyl-4-quinolone (7aq).

Pale brown crystals, yield 48%. Mp 320-322 °C. ^{1}H NMR (300.13 MHz, $CDCl_3$/DMSO (8:1)) δ = 1.86 (s, 3H, CH_3), 5.95 (s, 1H, Ar), 6.62 – 6.65 (m, 5H, Ar), 6.81 (d, ^{3}J = 7.0 Hz, 1H, Ar), 6.91 (t, ^{3}J = 7.9 Hz, 1H, Ar), 7.02 (s, 1H, Ar), 7.12 (d, ^{3}J = 7.6 Hz, 1H, Ar), 7.86 (dd, ^{3}J = 9.3 Hz, ^{4}J = 2.7 Hz, 1H, Ar), 8.75 (d, ^{4}J = 2.7 Hz, 1H, Ar). ^{13}C NMR (75 MHz, $CDCl_3$) δ = 20.19 (CH_3), 112.59, 118.64, 121.54 (3CH), 122.02, 124.42 (2C), 125.11, 127.62 (2CH), 127.83, 127.86 (4CH), 130.30 (CH), 130.39 (C), 131.66, 131.81 (2CH), 138.32, 138.51, 142.40, 144.61, 154.11, 175.41 (6C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3075 (w), 1644 (m), 1609 (m), 1586 (m), 1506 (m), 1471 (s), 1377 (m), 1334 (s), 1191 (w), 1060 (w), 909 (w), 859 (M), 828 (s), 794 (s), 745 (m), 702 (m), 656 (m), 533 (m). MS (GC, 70eV): *m/z* (%) = 437 (M^{+1}, 28), 436 (M^{+}, $C_{22}H_{15}N_2O_3{}^{80}$Br, 99), 435 ($M^{+1}$, 34), 434 ($M^{+}$, $C_{22}H_{15}N_2O_3{}^{81}$Br, 100), 408 (26), 390 (12), 388 (15), 281 (12), 280 (26), 278

(13), 266 (10), 265 (14), 164 (14), 139 (15), 115 (16), 75 (12). HRMS (EI): calcd for $C_{22}H_{15}N_2O_3{}^{80}Br$ 434.0261, found 434.0265; calcd for $C_{22}H_{15}N_2O_3{}^{81}Br$ 436.0240, found 436.0246.

1-(3,4-Dimethoxyphenethyl)-6-nitro-2-phenylquinolin-4(1*H*)-one (7ba).

Dark gray crystals, yield 89%. Mp 156-158 °C. ^{1}H NMR (300,13 MHz DMSO-d_6): δ= 2.84 (t, 2H, ^3J = 7.1 Hz, -CH_2CH_2Ar), 3.60 (s, 3H, -OCH_3), 3.72 (s, 3H, -OCH_3`), 4.34 (br s, 2H, -$CH_2CH_2$Ar), 6.09 (s, 1H, -COC*H*=), 6.25-6.40 (m, 2H, Ar`), 6.77 (d, 1H, ^3J = 8.1 Hz, Ar`), 7.34-7.64 (m, 5H, Ph), 8.28 (d, 1H, ^3J = 9.4 Hz, Ar), 8.56 (dd, 1H, ^3J = 9.4 Hz, ^4J = 2.7 Hz, Ar), 8.99 (d, 1H, ^4J = 2.7 Hz, Ar). ^{13}C NMR (250.13 MHz, DMSO-d_6): δ = 33.40, 49.87 (2 -CH_2-), 55.24, 55.52 (2 -OCH_3), 111.83, 112.16, 113.01, 119.99, 120.56, 121.68 (6CH, Ar), 125.96 (C), 126.18 (CH), 128.28, 128.59 (4CH, Ph), 129.29 (C), 129.62 (CH, Ph), 134.85, 142.64, 144.03, 147.64, 148.63, 155.83, 174.92 (7C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 2936 (w), 1634 (s), 1609 (m), 1515 (s), 1471 (s), 1421 (w), 1392 (w), 1332 (s), 1296 (m), 1264 (s), 1237 (s), 1189 (m), 1171 (m), 1144 (s), 1112 (m), 1065 (w), 1030 (m), 934 (w), 910 (w), 840 (m), 806 (s), 762 (m), 745 (s), 703 (m), 675 (m), 626 (w), 542 (w). MS (GC, 70eV): *m/z* (%) = 430 (M^+, 15), 413 (48), 400 (33), 277 (57), 249 (45), 233 (20), 206 (12), 199 (18), 183 (16), 178 (32), 1643 (89), 151 (86), 141 (21), 131 (11), 78 (40), 65 (26), 63 (100), 57 (15), 44 (57). HRMS (ESI): calcd for $C_{25}H_{22}N_2O_3$ 430.1523, found 430.1529.

1-(4-Methoxybenzyl)-6-nitro-2-phenylquinolin-4(1*H*)-one (7bb).

Brown crystals, yield 61%. Mp 227-229 °C. ^{1}H NMR (300,13 MHz; DMSO-d_6): δ= 3.67 (s, 3H, -OCH_3), 5.33 (s, 2H, -CH_2-), 6.20 (s, 1H, -COC*H*=), 6.83 (d, 2H, ^3J = 8.5 Hz, Ar`), 6.98 (d, 2H, $^3J$ = 8.5 Hz, Ar`), 7.50 (s, 5H, -Ph), 7.80 (d, 1H, ^3J = 9.5 Hz, Ar), 8.37 (dd, 1H, ^3J = 9.5 Hz, ^4J = 2.7 Hz, Ar), 8.92 (d, 1H, ^4J = 2.7 Hz, Ar). ^{13}C NMR (250.13 MHz, DMSO-d_6): δ = 51.22 9 (CH_2), 54.96 (CH_3), 113.27 (CH), 114.22 (2CH), 120.34, 121.53 (2CH), 126.11 (C), 126.13 (CH), 126.94 (2CH), 127.50 (C), 128.10, 128.74 (4CH), 129.90 (CH), 134.69, 142.75, 144.36, 156.09, 158.49, 175.12 (6C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 2952 (w), 1608 (s), 1512 (s), 1470 (m), 1332 (s), 1245 (s), 1172 (m), 1028 (s), 802 (s), 709 (s). MS (GC, 70eV): *m/z* (%) = 386 (M^+, 4), 122 (38), 121 (100), 78 (12), 77 (14). HRMS (ESI): calcd for C23H18N2O4 386.1260, found 386.1267.

6-Nitro-1-phenethyl-2-phenylquinolin-4(1*H*)-one (7bc).

Yellow crystals, yield 79%. Mp 263-265 °C. ^{1}H NMR (300,13 MHz DMSO-d_6/CF_3COOD): δ=2.90 (s, 2H, -CH_2CH_2Ph), 4.75 (s, 2H, -CH_2CH_2Ph), 6.47 (d, 2H, ^3J = 6.5 Hz, Ph`), 6.87-7.15 (m, 3H, Ph` + 3H, Ph), 7.27-7.49 (m, 2H, Ph + 1H, -COCH=), 8.28 (d, 1H, ^3J = 9.2 Hz, Ar), 8.67 (d, 1H, ^3J = 9.2 Hz, Ar), 9.20 (s, 1H, Ar). ^{13}C NMR (300,13 MHz DMSO-d_6/CF_3COOD): δ=37.10, 55.30 ($2CH_2$), 112.65, 123.44, 124.22 (3CH), 124.28 (C), 129.91 (CH), 130.33, 131.07 (4CH), 131.15 (CH), 131.44, 131.67 (4 CH), 133.72 (CH), 135.60,138.28, 145.07, 148.22, 165.60, 173.50 (6C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3055(s), 1634 (w), 1600 (m), 1557 (s), 1519 (m), 1494 (m), 1468 (w), 1443 (m), 1391 (s), 1368 (s), 1329 (w), 1294,3 (m), 1255 (m), 1192 (m), 1166(m), 1145 (m), 1114 (m), 1078 (m), 1030 (s), 984 (m), 924 (m), 857 (w), 822 (w), 800 (m), 761 (w), 734 (w), 706 (w), 671 (m), 631 (m), 591 (m), 545 (m). MS (GC, 70eV): *m/z* (%) = 370 (M^+, 43), 279 (100), 233 (54), 177 (17), 131 (21). HRMS (EI): calcd for $C_{23}H_{18}N_2O_3$ 370.1312, found 370.1312.

6-Nitro-4-oxo-2-phenyl-1-(3-phenylpropyl)quinoline (7bd).

Yellow crystals, yield 66%. Mp 180 °C. ^{1}H NMR (300,13 MHz DMSO-d_6): δ= 1.94 (br s, 2H, -CH_2 CH_2 CH_2Ph), 2.47 (m, 2H, -CH_2 CH_2 CH_2Ph), 4.10 (br s, 2H, -CH_2 CH_2 CH_2Ph), 6.09 (s, 1H, -COCH=), 6.90-7.30 (m, 5H, Ph`), 7.56 (s, 5H, Ph), 8.05 (d, 1H, ^3J = 8.6 Hz, Ar), 8.47 (d, 1H, ^3J = 8.6 Hz, Ar), 8.93 (s, 1H, Ar). ^{13}C NMR (250.13 MHz, DMSO-d_6): δ = 29.09, 31.60, 47.92 (3C, -*n*-C_3H_6Ph), 113,08, 119.58, 121.71, 125.88 (4CH, Ar), 125.95 (1C, Ph), 126.01 (1C, Ar), 127.90, 128.26 (4CH, Ph), 128.11, 128.73 (4CH, Ph`), 129.69 (1CH, Ph`), 134.77, 140.09, 142.56, 144.07, 155.67, 174.91 (7C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3055 (w), 2939 (w), 1627 (s), 1609 (s), 1580 (m), 1556 (w), 1516 (w), 1494 (w), 1465 (m), 1389 (m), 1331 (s), 1296 (m), 1211 (w), 1188 (m), 1167 (m), 1144 (m), 1113 (m), 1069 (m), 1050 (m), 1031 (w), 1013 (w), 933 (w), 910 (w), 846 (m), 814 (w), 763 (m), 746 (m), 735 (s), 704 (m), 692 (s), 674 (s). MS (GC, 70eV): *m/z* (%) = 384 (M^+, 100), 354 (11), 280 (18), 279 (92), 266 (20), 233 (45), 177 (20), 131 (15), 118 (15), 91 (81). HRMS (ESI): calcd for $C_{24}H_{22}N_2O_3$ 385.1547, found 385.1547.

1-Heptyl-6-nitro-2-phenylquinolin-4(1*H*)-one (7be).

Dark crystals, yield 90%. Mp 142-144 °C. ^{1}H NMR (300,13 MHz DMSO-d_6): δ= 0.81 (t, 3H, ^3J = 6.7 Hz, -C_6H_{12}-CH_3), 0.98-1.20 (br m, 8H, -C_2H_4-C_4H_8-CH_3), 1.61 (br s, 2H, -CH_2-CH_2-C_5H_{11}), 4.11 (t, 2H, ^3J = 7.4 Hz, -CH_2-C_6H_{13}), 6.12 (s, 1H, -COCH=), 7.61 (s, 5H, Ph), 8.11 (d, 1H, ^3J = 9.5 Hz, Ar), 8.51 (dd, 1H, ^3J = 9.5 Hz, ^4J = 2.5 Hz, Ar), 8.94 (d, 1H, ^4J = 2.5 Hz, Ar). ^{13}C NMR (250.13 MHz, DMSO-d_6): δ = 13.77 (-C_6H_{12}-CH_3), 21.84, 25.46, 27.63, 27.70, 30.79,

48.15 (6CH_2, -C_6H_{12}-CH_3), 113.07, 119.72, 121.69 (3CH), 125.95 (C), 126.14 (CH), 128.27 (2CH, Ph), 128.73 (2CH, Ph), 129.70 (CH, Ph), 134.94, 142.57, 144.03, 155.69, 174.88 (5C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3062 (w), 2924 (w), 2853 (w), 1640 (m), 1602 (m), 1583 (m), 1515 (m), 1468 (s), 1393 (w), 1328 (s), 1188 (w), 1170 (w), 1140 (w), 1110 (m) 1057 (w), 1014 (w), 935 (w), 910 (w), 852 (m), 823 (m), 802 (m), 765 (s), 745 (s), 705 (s), 674 (m), 633 (w). MS (GC, 70eV): *m/z* (%) = 364 (M^+, 70), 293 (14), 287 (19), 279 (100), 266 (75), 245 (18), 233 (62), 204 (10), 191 (12), 177 (29), 131 (21), 57 (10), 43 (11), 41 (12). HRMS (EI): calcd for $C_{22}H_{24}N_2O_3$ 364.1781, found 364.1773.

1-Cyclohexane-6-nitro-4-oxo-2-phenylquinoline (7bf).

Yellow crystals, yield 60%. Mp 272-274 °C. ^{1}H NMR (300,13 MHz DMSO-d_6/CF_3COOD): δ= 0.80-2.50 (m, 10H, cyclohexyl), 4.55 (t, 1H, ^3J = 11.6 Hz, cyclohexyl), 6.95 (s, 1H, -COC*H*=), 7.40-7.70 (m, 5H, Ph), 8.62 (s, 2H, Ar), 9.20 (s, 1H, Ar). ^{13}C NMR (250,13 MHz DMSO-d_6/CF_3COOD): δ= 25.86 (1 -CH_2-), 27.80, 32.17 (4 -CH_2-), 69.15, 112.96, 123.54, 124.18 (4 CH), 125.46 (1 C), 128.67 (1 CH), 128.94, 131.12 (4 CH), 132.72 (1 CH), 136.80, 144.92, 146.51, 163.94, 174.20 (5 C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 2938(s), 2854(s), 1645(m), 1610(s), 1581(s), 1513(s), 1469(m), 1442(m), 1383(s), 1330(w), 1278 (s), 1262 (s), 1225(s), 1188(s), 1167(s), 1141 (s), 1099 (s), 1067 (s), 1031 (s), 984 (s),934 (s), 913 (s), 857 (m), 829 (s), 793 (s), 767 (m), 744 (m), 706 (w), 677 (s), 636 (s), 573 (s), 543 (s). MS (GC, 70eV): *m/z* (%) = 348 (M^+, 24), 266 (100), 190 (11), 83 (14), 55 (27), 41 (11). HRMS (EI): calcd for $C_{21}H_{20}N_2O_3$ 348.1467, found 348.1468.

1-Hexyl-6-nitro-2-phenylquinolin-4(1*H*)-one (7bg).

Red-Brown crystals, yield 81%. Mp 159-160 °C. ^{1}H NMR (300,13 MHz; DMSO-d_6): δ= 0.77 (t, 3H, ^3J = 7.0 Hz, -C*H*$_3$), 0.97-1.16 (br m, 6H, -(CH_2)$_2$-(C*H*$_2$)$_3$-CH_3), 1.53-1.64 (m, 2H, -CH_2-C*H*$_2$-C_4H_9), 4.11 (t, 2H, ^3J = 7.9 Hz, -C*H*$_2$-C_5H_{11}), 6.12 (s, 1H, -COC*H*=), 7.62 (s, 5H, Ph), 1.05 (d, 1H, ^3J = 9.5 Hz, Ar), 8.51 (dd, 1H, ^3J = 9.5 Hz, ^4J = 2.9 Hz, Ar), 8.94 (d, 1H, ^4J = 2.9 Hz, Ar). ^{13}C NMR (250.13 MHz, DMSO-d_6): δ = 13.68 (-CH_3), 21.70, 25.19, 27.69, 30.19, 48.19 (5CH_2), 113.08, 119.76, 121.72 (3CH), 125.96 (C), 126.19 (CH), 128.30, 128.77 (4CH, Ph), 129.73 (CH, Ph), 134.96, 142.60, 144.05, 155.74, 174.92 (5C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 2922 (w), 1641 (m), 1602 (m), 1583 (m), 1515 (w), 1469 (s), 1394 (w), 1328 (s), 1249 (w), 1188 (w), 1172 (m), 1111 (m), 1056 (m), 1019 (w), 991 (w), 935 (w), 911 (w), 853 (m), 823 (w), 801 (w), 766 (s), 745 (s), 707 (s), 674 (m), 633 (w), 539 (w). MS (GC, 70eV): *m/z* (%) = 350 (M^+, 95), 279 (100), 273

(12), 266 (25), 233 (69), 221 (12), 204 (15), 190 (14), 177 (17), 165 (11), 131 (25), 76 (10), 43 (30), 41 (24). HRMS (ESI): calcd for $C_{21}H_{22}N_2O_3$ 350.1624, found 350.1630.

1-(3,5-Dimethoxybenzen)-6-nitro-4-oxo-2-phenylquinoline (7bh).

Yellow crystals, yield 47%. Mp 248-251 °C. ^{1}H NMR (300,13 MHz DMSO-d_6/$CDCl_3$ 1:5): δ= 3.38 (s, 6H, 2C*H*$_3$O-), 6.05 (d, 3H, ^4J = 2.5 Hz, Ar), 6.10 (s, 1H, -COC*H*=), 6,88 (d, 1H, ^3J = 9.4 Hz, Ar), 6.95 (s, 5H, Ph), 7.93 (dd, 1H, ^3J = 9.4 Hz, ^4J = 2.6 Hz, Ar), 8.85 (d, 1H, ^4J = 2.6 Hz, Ar). ^{13}C NMR (300,13 MHz DMSO-d_6/$CDCl_3$ 1:5): δ= 55.07 (2 CH_3), 100.73 (1 CH), 107.41 (2 CH), 112.91, 119.41, 121.91 (3 CH), 124.77 (1 C), 125.29 (1 CH), 127.46,128.16 (4 CH), 128.64 (1 CH), 134.06, 138.98, 142.73, 145.01, 154.40 (5 C), 160.91 (2 C), 175.93 (1 C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3078 (w), 2937 (w), 1583 (s), 1456 (s), 1330 (s), 1193 (m), 1155 (s), 1058 (m), 922 (w), 820 (m), 745 (m), 698 (m), 588 (m). MS (GC, 70eV): *m/z* (%) = 403 (M^{+1}, 29), 402 (M^+, 100), 356 (14). HRMS (EI): calcd for $C_{23}H_{18}N_2O_5$ 402.1210, found 402.1212.

6-Nitro-1-(3,4-dimethoxyphenethyl)-2-*p*-tolyl-4-quinolone (7ca).

Yellow crystals, yield 82%. ^{1}H NMR (300 MHz, $CDCl_3$) δ = 0.93 (t, ^3J = 7.3 Hz, 3H, -$CH_2CH_2CH_2CH_3$), 1.32 – 1.45 (m, 2H, -$CH_2CH_2CH_2CH_3$), 1.53 – 1.63 (m, 2H, -$CH_2CH_2CH_2CH_3$), 2.43 (t, 2H, ^3J = 7.1 Hz, -$CH_2CH_2CH_2CH_3$), 3.04 (t, ^3J = 7.1 Hz, 2H, -NCH_2CH_2-), 3.79 (s, 3H, -OCH_3), 3.84 (s, 3H, -OCH_3), 4.41 (t, ^3J = 7.2 Hz, 2H, -NCH_2CH_2-), 6.20 (s, 1H, Ar), 6.52 (d, ^4J = 1.9 Hz, 1H, Ar), 6.62 (dd, ^3J = 8.1 Hz, ^4J = 1.9 Hz, 1H, Ar), 6.79 (d, ^3J = 8.2 Hz, 1H, Ar), 7.65 (d, ^4J = 9.5 Hz, 1H, Ar), 8.40 (dd, ^3J = 9.5 Hz, ^4J = 2.8 Hz, 1H, Ar), 9.22 (d, ^4J = 2.8 Hz, 1H, Ar). ^{13}C NMR (63.00 MHz, $CDCl_3$) δ = 13.66 (CH_3), 22.36, 30.51, 33.47, 34.45, 47.87 (5CH_2), 55.96 (2CH_3), 111.70, 111.77, 112.43, 117.04, 120.73, 123.55, 126.09 (7CH), 126.45, 128.89, 142.96, 144.18, 148.48, 149.34, 156.12, 176.50 (8C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 2955 (w), 2935 (w), 1632 (s), 1606 (m), 1576 (m), 1515 (s), 1466 (s), 1446 (m), 1421 (m), 1399 (w), 1334 (s), 1283 (m), 1265 (s), 1237 (s), 1213 (m), 1189 (w), 1159 (s), 1142 (s), 1101 (m), 1023 (m), 939 (w), 930 (m), 912 (w), 840 (s), 821 (s), 804 (m), 761 (m), 744 (s), 671 (w), 648 (m), 625 (m), 560 (w), 542 (w). MS (GC, 70eV): *m/z* (%) = 410 (M^+, 5), 409 (M^+, 5), 151 (100). HRMS (ESI): calcd for $C_{23}H_{26}N_2O_5$ 410.1828, found 410.1836.

2-Butyl-1-(3,5-dimethoxyphenyl)-6-nitroquinolin-4(1*H*)-one (7cb).

Brown crystals, yield 39%. Mp 162-164 °C. ^{1}H NMR (300,13 MHz DMSO-d_6): δ= 0.79 (t, 3H, ^3J = 7.1 Hz, -C_3H_6-C*H*$_3$), 1.18-1.29 (m, 2H, -C_2H_4-C*H*$_2$-CH_3), 1.48-1.59 (m, 2H, -CH_2-C*H*$_2$-

C_2H_5), 2.40 (t, 2H, ^3J = 7.5 Hz, -C*H*$_2$-C_3H_7), 3.85 (s, 6H, 2 -OC*H*$_3$), 6.28 (s, 1H, -COC*H*=), 6.83 (s, 3H, Ar`), 7.00 (d, 1H, $^3J$ = 9.3 Hz, Ar), 8.31 (d, 1H, $^3J$ = 9.3 Hz, Ar), 8.85 (s, 1H, Ar). $^{13}$C NMR (300.13 MHz, DMSO-$d_6$): δ = 13.40 (-$CH_3$), 21.65, 30.03, 32.46 (3 $CH_2$-), 55.79 (2 $OCH_3$), 101.92 (CH), 107.20 (2CH, Ar`), 110.26, 120.09, 121.10, 124.28 (4CH), 125.78, 139.13, 142.47, 145.68, 156.39 (5C), 161.72 (2C, Ar`), 175.51 (C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 2959 (w), 1632 (m), 1607 (s), 1584 (s), 1515 (w), 1467 (s), 1326 (s), 1297 (m), 1256 (m), 1195 (s), 1156 (s), 1060 (s), 992 (w), 930 (w), 910 (w), 860 (w), 844 (m), 814 (m), 746 (m), 710 (m), 670 (w), 618 (w), 591 (m), 536 (m). MS (GC, 70eV): *m/z* (%) = 382 (M^+, 39), 340 (100), 325 (10), 323 (18), 311 (71), 297 (11), 283 (10), 265 (10). HRMS (ESI): calcd for $C_{21}H_{22}N_2O_5$ 382.1518, found 382.1529.

2-Butyl-1-(4-methoxyphenyl)-6-nitroquinolin-4(1*H*)-one (7cc).

Brown crystals, yield 72%. Mp 171-173 °C. ^{1}H NMR (300,13 MHz DMSO-d_6): δ= 0.76 (t, 3H, ^3J = 7.3 Hz, -CH_3), 1.14-1.27 (m, 2H, - C*H*$_2$$CH_3$), 1,48 (m, 2H, - C*H*$_2$ CH_2CH_3), 2.34 (t, 2H, ^3J = 8.1 Hz, =NC*H*$_2$-), 3.92 (s, 3H, -OC*H*$_3$), 6.31 (s, 1H, -COC*H*=), 6.89 (d, 1H, ^3J = 9.4 Hz, Ar), 7.26 (d, 2H, ^3J = 8.9 Hz, Ar), 7.52 (d, 2H, ^3J = 8.9 Hz, Ar), 8.30 (dd, 1H, ^3J = 9.4 Hz, ^4J = 2.8, Ar), 8.88 (d, 1H, ^4J = 2.8, Ar). ^{13}C NMR (250.13 MHz, DMSO-d_6): δ = 13.32 (CH_3), 21.59, 29.79, 32.84 (CH_2), 55.57 (CH_3), 110.46 (CH), 115.57 (2CH), 119.93, 121.22 (2CH), 124.47 (C), 125.72 (CH), 129.98 (C), 130.27 (2CH), 142.46, 146.35, 156.97, 159.97, 175.52 (5C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 2930 (w), 1610 (s), 1506 (s), 1464 (s), 1330 (s), 1244 (s), 1031 (m), 918 (m), 823 (m), 745 (m), 549 (m). MS (GC, 70eV): *m/z* (%) = 352 (M^+, 22), 311 (18), 310 (100), 309 (23), 121 (33). HRMS (EI): calcd for $C_{20}H_{20}N_2O_4$ 352.1418, found 352.1419.

2-Butyl-1-(4-*tert*-butylphenyl)-6-nitroquinolin-4(1*H*)-one (7cd).

Brown crystals, yield 42%. Mp 127-129 °C. ^{1}H NMR (300,13 MHz DMSO-d_6): δ= 0.67 (t, 3H, ^3J = 7.3 Hz, -CH_3), 0.83-1.30 (br m, 6H), 1.41 (s, 9H, 3CH_3), 2.31 (t, 2H, ^3J = 8.0 Hz, -CH_2), 6.34 (s, 1H, COC*H*=), 6.86 (d, 1H, ^3J = 9.4 Hz, Ar), 7.50 (d, 2H, ^3J = 8.5 Hz, Ph), 7.75 (d, 2H, ^3J = 8.5 Hz, Ph), 8.33 (dd, 1H, ^3J = 9.4 Hz, ^4J = 2.8 Hz, Ar), 8.91 (d, 1H, ^4J = 2.4 Hz, Ar). ^{13}C NMR (250.13 MHz, DMSO): δ = 13.01 (1CH_3), 21.45, 29.82 (2 CH_2), 30.97 (3CH_3), 32.67 (CH_2), 34.67 (C), 110.61, 119.80, 121.27 (3CH), 124.46 (C), 125.83 (CH), 127.25, 128.60 (4CH), 134.85, 142.51, 145.98, 152.80, 156.67, 175.49. IR (ATR, cm^{-1}): $\tilde{\nu}$ = 2958 (m), 1633 (m), 1610 (m), 1520 (m), 1464 (m), 1335 (s), 1107 (m), 919 (w), , 837 (m), 745 (m), 569 (m).

MS (GC, 70eV): *m/z* (%) = 378 (M^+, 15), 337 (13), 336 (66), 322 (21), 321 (100), 275 (10). HRMS (EI): calcd for $C_{23}H_{26}N_2O_3$ 378.1938, found 378.1938.

6-Nitro-(3,4-dimethoxyphenethyl)-2-pentyl-4-quinolone (7da).

Yellow crystals, yield 60%. Mp 170-172 °C. ^{1}H NMR (300 MHz, $CDCl_3$) δ = 0.89 (t, ^3J = 9.3, 3H, -$(CH_2)_4CH_3$), 1.31 – 1.36 (m, 4H, -$(CH_2)_4CH_3$), 1.58 – 1.63 (m, 2H, -$(CH_2)_4CH_3$), 2.42 (t, ^3J = 7.2 Hz, 2H, -$(CH_2)_4CH_3$), 3.04 (t, ^3J = 7.2 Hz, 2H, -NCH_2CH_2-), 3.79 (s, 3H, -OCH_3), 3.85 (s, 3H, -OCH_3), 4.41 (t, ^3J = 7.2 Hz, 2H, -NCH_2CH_2-), 6.21 (s, 1H, Ar), 6.52 (d, ^4J = 2.0 Hz, 1H, Ar), 6.62 (dd, ^3J = 8.1 Hz, ^4J = 2.0 Hz, 1H, Ar), 6.79 (d, J = 8.2 Hz, 1H, Ar), 7.65 (d, ^3J = 9.5 Hz, 1H, Ar), 8.41 (dd, ^3J = 9.5 Hz, ^4J = 2.8 Hz, 1H, Ar), 9.18 (d, ^4J = 2.8 Hz, 1H, Ar). ^{13}C NMR (300 MHz, $CDCl_3$) δ = 13.85 (CH_3), 22.26, 28.14, 31.36, 33.73, 34.46, 47.86 (6 CH_2), 55.95 (2 CH_3), 111.68, 111.76, 112.44, 117.01, 120.72, 123.59, 126.10 (7 CH), 126.47, 128.86, 142.98, 144.17, 148.50, 149.35, 156.11, 176.52 (8 C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 2953 (w), 1633 (s), 1608 (m), 1575 (m), 1516 (s), 1464 (m), 1414 (w), 1332 (s), 1298 (w), 1284 (w), 1264 (m), 1237 (s), 1208 (w), 1158 (s), 1142 (m), 1099 (s), 1026 (m), 932 (w), 912 (w), 845 (w), 832 (m), 821 (w), 802 (2), 765 (w), 744 (m), 673 (w), 650 (w), 627 (w), 601 (w), 561 (w), 542 (w). MS (GC, 70eV): *m/z* (%) = 424 (M^{-1}, 3), 407 (23), 152 (11), 151 (100). HRMS (EI): calcd for $C_{24}H_{29}N_2O_5$ 425.2071, found 425.2071.

1-(4-Methoxybenzyl)-6-nitro-2-pentylquinolin-4(1*H*)-one (7db).

Pale pink crystals, yield 51%. Mp 120-122 °C. ^{1}H NMR (300.13 MHz, $CDCl_3$): δ= 0.87 (t, 3H, ^3J = 7.1 Hz, -C_4H_8-CH_3), 1.30-1.40 (m, 4H, -C_2H_4-C_2H_4-CH_3), 1.70 (p, 2H, ^3J = 7.5 Hz, -CH_2-CH_2-C_3H_7), 2.68 (t, 2H, ^3J = 7.8 Hz, -CH_2-C_4H_9), 3.77 (s, 3H, -OCH_3), 5.39 (s, 2H, -CH_2-), 6.34 (s, 1H, -COC*H*-), 6.86 (d, 2H, ^3J = 8.8 Hz, Ar`), 6.95 (d, 2H, $^3J$ = 8.8 Hz, Ar`), 7.40 (d, 1H, ^3J = 9.5 Hz, Ar), 8.23 (dd, 1H, ^3J = 9.5 Hz, ^4J = 2.8 Hz, Ar), 9.21 (d, 1H, ^4J = 2.8 Hz, Ar). ^{13}C NMR (300 MHz, $CDCl_3$): δ = 13.77 (CH_3), 22.23, 28.21, 31.22, 33.78, 49.76 (5CH_2), 55.29 (CH_3), 112.44 (CH), 114.86 (2CH), 117.88, 123.13 (2CH), 126.04 (2CH), 126.17, 126.28 (2C), 126.32 (2CH), 143.05, 144.87, 156.18, 159.48, 176.77. IR (ATR, cm^{-1}): $\tilde{\nu}$ = 2931 (w), 1632 (s), 1609 (s), 1514 (m), 1471 (s), 1334 (s), 1289 (s), 1248 (s), 1176 (s), 1099 (m), 1034 (m), 831 (m), 800 (m), 743 (s),668 (m), 553 (m). MS (GC, 70eV): *m/z* (%) = 380 (M^+, 3), 121 (100). HRMS (ESI-TOF): calcd for $C_{22}H_{24}N_2O_4$ 380.1731, found 380.1734.

General procedure for the synthesis of 8.

A predried Schlenk flask was charged with a magnetic stirrer, 4-quinolone **7** (200 mg, 1 equiv.), 10% Pd/C (0.1 wt. equiv.) and a fresh distilled methanol (20 ml). The Schlenk tube was threefold refilled with hydrogen. After 4-5 h in an atmosphere of hydrogen and an intense stirring at room temperature (TLC control) the reaction mixture was filtered through a fine silica gel pad and purified by a column chromatography (silica gel, methanol / ethyl acetate, 1:80) or recrystallized from a solution of ethyl acetate and *n*-heptane.

6-Amino-1-(3,4-dimethoxyphenethyl)-2-*p*-tolylquinolin-4(1*H*)-one (8aa).

Yellow crystals, yield 64%. Mp 219-221 °C. ^{1}H NMR (300,13 MHz DMSO-d_6): δ= 2.41 (s, 3H, -Tol), 2.82 (t, 2H, ^{3}J = 9.4 Hz, =N -CH_2-CH_2-), 3.59 (s, 3H, Ar` + $H_2O$), 3.73 (s, 3H, Ar`), 4.21 (t, 2H, ^{3}J = 9.4 Hz, =N -CH_2-CH_2-), 5.40 (br s, 2H, -NH_2), 5.74 (s, 1H, -COC*H*=), 6.24 (d, 1H, ^{4}J = 1.8 Hz, Ar), 6.40 (dd, 1H, ^{4}J = 1.8 Hz, ^{3}J = 8.1 Hz, Ar), 6.78 (d, 1H, ^{3}J = 8.1 Hz, Ar), 7.15-7.21 (m, 2H, -Tol + 1H, Ar`), 7.32 (d, 2H, $^{3}J$ = 7.9 Hz, -Tol), 7.42 (d, 2H, $^{3}J$ = 2.8 Hz, Ar`), 7.79 (d, 1H, ^{3}J = 9.2 Hz, Ar`). ^{13}C NMR (250.13 MHz, DMSO-d_6): δ = 21.20 (CH_3), 34.49, 49.34 ($2CH_2$), 55.52, 55.89 ($2CH_3$), 109.37, 111.21, 111.30, 111.52, 117.59, 120.61, 121.57 (7CH), 128.31 (2CH), 128.61 (C), 129.02 (2CH), 129.49, 133.18, 133.47, 138.99, 143.09, 147.93, 148.93, 153.59, 176.52 (9C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3314 (w), 2915 (w), 1589 (s), 1564 9s), 1511 (s), 1485 (s), 1418 (m), 1311 (m), 1253 (s), 1236 (s), 1177 (m), 1153 (s), 1030 (s), 942 (w), 834 (s), 806 (s), 757 (m), 624 (m), 556 (m). MS (GC, 70eV): *m/z* (%) = 415 (M^{+1}, 18), 414 (M^{+}, 75), 413 (M^{-1}, 11), 264 (30), 263 (100), 262 (10), 249 (10), 248 (65), 165 (11), 147 (15). HRMS (EI): calcd for $C_{26}H_{26}N_2O_3$ 414.1938, found 414.1930.

6-Amino-1-(4-methoxybenzyl)-2-*p*-tolylquinolin-4(1*H*)-one (8ab).

Yellow crystals, yield 89%. Mp 267-269 °C. ^{1}H NMR (250 MHz, DMSO-d_6): δ= 2.36 (s, 3H, -CH_3, -Tol), 3.71 (s, 3H, -OCH_3, -Ar`), 5.25 (s, 2H, -CH_2-), 5.39 (s, 2H, -NH_2), 5.89 (s, 1H, -COC*H*=), 6.83-6.98 (m, 5H, Ar), 7.25-7.40 (m, 6H, Ar). ^{13}C NMR (300 MHz, DMSO-d_6): δ= 21.24 (CH_3), 51.68 (CH_2), 55.21 (CH_3), 108.92, 111.43 (2CH), 114.29 (2CH), 118.78, 121.54 (2CH), 126.62, 128.06 (4CH), 128.36, 128.53 (2C), 129.20 (2CH), 132.91, 134.21, 139.52, 143.06, 154.06, 158.83, 176.75 (7C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3213 (w), 1557 (s), 1486 (s), 1417 (m), 1300 (m), 1248 (s), 1180 (s), 1023 (m), 811 (s), 560 (m). MS (GC, 70eV): *m/z* (%) = 370 (M^{+}, 22), 250 (15), 122 (10), 121 (100). HRMS (EI-HR): calcd for $C_{24}H_{22}N_2O_2$ 370.1676, found 370.1672.

6-Amino-1-(1-phenylethyl)-2-*p*-tolylquinolin-4(1*H*)-one (8ac).

Yellow crystals, yield 62%. Mp 153-155 °C. ^{1}H NMR (300,13 MHz, DMSO-d_6): δ= 1.93 (t, 3H, ^{3}J = 6.5 Hz, PhC*H*$_3$CH), 2.36 (s, 3H, -C*H*$_3$, -Tol), 3.15-5.50 (-N*H*$_2$ + H_2O), 5.62 (q, 1H, ^{3}J = 6.8 Hz, PhCH$_3$C*H*), 5.79 (solvent C*H*$_2$Cl$_2$), 5.88 (s, 1H, -COC*H*=), 6.75 (dd, 1H, ^{3}J = 9.2 Hz, ^{4}J = 2.8 Hz, Ar), 6.98 (d, 1H, ^{3}J = 9.2 Hz, Ar), 7.24 (d, 2H, ^{3}J = 7.8 Hz, Ar), 7.29-7.37 (m, 5H, Ar), 7.41 (d, 1H, ^{4}J = 2.8 Hz, Ar), 7.48 (d, 2H, ^{3}J = 7.8 Hz, Ar). ^{13}C NMR (300,13 MHz, DMSO-d_6): δ = 17.32, 20.73 (2CH$_3$), 57.75 (CH, -*C*HCH$_3$Ph), 106.34, 109.84, 119.58, 120.82 (4CH), 125.22 (2CH), 126.95, 127.40, 127.51 (3CH), 127.59 (C), 128.77, 129.37 (4CH), 130.20, 133.82, 138.82, 140.46, 144.72, 153.30, 174.95 (7C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3222 (w), 2919 (m), 1588 (s), 1563 (s), 1487 (s), 1415 (m), 1377 (m), 1282 (m), 1258 (s), 1179 (m), 1075 (m), 1018 (m), 814 (s), 558 (m). MS (GC, 70eV): *m/z* (%) = 355 (M^{+1}, 6), 349 (50), 348 (100), 347 (11), 264 (22), 263 (92), 251 (10), 250 (53), 249 (19), 248 (50), 147 (11). HRMS (EIHR): calcd for $C_{24}H_{22}N_2O$ 354.4401, found 354.4398.

6-Amino-1-heptyl-2-*p*-tolylquinolin-4(1*H*)-one (8ad).

Yellow crystals, yield 77%. Mp 177-178 °C. ^{1}H NMR (300,13 MHz DMSO-d_6): δ= 0.81 (t, 3H, ^{3}J = 6.9 Hz, C$_6$H$_{12}$-C*H*$_3$), 0.90-1.25 (br m, 8H, CH$_2$-(C*H*$_2$)$_4$-CH$_3$), 1.56 (br s, 2H, -CH$_2$-C*H*$_2$-C$_5$H$_{11}$), 2.41 (s, 3H, Tol-C*H*$_3$), 4.00 (t, 2H, ^{3}J = 7.1 Hz, -C*H*$_2$-C$_6$H$_{13}$), 5.43 (s, 2H, NH$_2$), 5.77 (s, 1H, -COC*H*=), 7.14 (dd, 1H, ^{3}J = 9.0 Hz, ^{4}J = 2.2 Hz, Ar), 7.36 (s, 4H, -Tol), 7.40 (d, 1H, ^{4}J = 2.2 Hz, Ar), 7.58 (d, 1H, ^{3}J = 9.0 Hz, Ar). ^{13}C NMR (300.13 MHz, DMSO-d_6): δ = 13.74, 20.80 (2CH$_3$), 21.89, 25.54, 27.72, 28.09, 30.81, 47.10 (6CH$_2$), 106.28, 109.57, 118.26, 120.88 (4CH), 128.24 (2CH, -Tol), 128.39 (C), 129.06 (2CH, -Tol), 131.89, 133.36, 138.52, 145.12, 152.33, 174.84 (6C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3382 (w), 3224 (m), 2918 (m), 1644 (w), 1588 (s), 1562 (s), 1493 (s), 1415 (m), 1379 (m), 1282 (m), 1179 (m), 1107 (w), 937 (w), 822 (s), 717 (m), 558 (m). MS (GC, 70eV): *m/z* (%) = 349 (M^{+1}, 25), 348 (M^{+}, 100), 263 (64), 250 (31), 248 (33), 221 (12), 147 (10), 41 (11). HRMS (ESI): calcd for $C_{23}H_{28}N_2O$ 348.2196, found 348.2202.

6-Amino-1-hexyl-2-*p*-tolylquinolin-4(1*H*)-one (8ae).

Yellow crystals, yield 82%. Mp 196-197 °C. ^{1}H NMR (300,13 MHz DMSO-d_6): δ= 0.77 (t, 3H, ^{3}J = 7.0 Hz, -C$_5$H$_{10}$-C*H*$_3$), 0.97-1.15 (m, 6H, -C$_2$H$_4$-(C*H*$_2$)$_3$CH$_3$), 1.56 (br s, 2H, -CH$_2$-C*H*$_2$-C$_4$H$_9$), 2.42 (s, 3H, -C*H*$_3$, -Tol), 4.01 (t, 2H, ^{3}J = 7.4 Hz, -C*H*$_2$C$_5$H$_{11}$), 5.42 (s, 2H, NH$_2$), 5.77 (s, 1H, COCH=), 7.13 (dd, 1H, ^{3}J = 9.0 Hz, ^{4}J = 2.5 Hz, Ar), 7.37 (s, 4H, Tol), 7.39 (d, 1H, ^{4}J = 2.5 Hz, Ar), 7.59 (d, 1H, ^{3}J = 9.0 Hz, Ar). ^{13}C NMR (300.13 MHz, DMSO-d_6): δ = 13.69, 20.82

($2CH_3$), 21.72, 25.28, 28.11, 30.31, 47.14 ($5CH_2$), 106.27, 109.57, 118.28, 120.90 (4CH), 128.26 (2CH, -Tol), 128.39 (C), 129.07 (2CH, -Tol), 131.90, 133.37, 138.56, 145.12, 152.37, 174.84 (6C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3329 (w), 3223 (m), 2918 (m), 1644 (w), 1587 (s), 1562 (s), 1491 (s), 1413 (m), 1372 (m), 1279 (m), 1179 (m), 1107 (m), 1016 (m), 936 (m), 823 (s), 720 (m), 559 (m).MS (GC, 70eV): *m/z* (%) = 335 (M^{+1}, 25), 334 (M^+, 100), 263 (61), 250 (23), 248 (32), 221 (10), 147 (9), 43 (11). HRMS (ESI): calcd for $C_{22}H_{26}N_2O$ 334.2040, found 334.2043.

6-Amino-1-cyclohexyl-2-*p*-tolylquinolin-4(1*H*)-one (8af).

Brown powder, yield 68%. Mp 108-110 °C. ^{1}H NMR (300,13 MHz DMSO-d_6): δ= 0.90 (br d, 2H, ^3J = 6.9 Hz, Cyclohexyl), 1.26 (br s, 2H, Cyclohexyl), 1.52 (br d, 2H, ^3J = 12.0 Hz, Cyclohexyl), 1.78 (t, 4H, ^3J = 10.1 Hz, Cyclohexyl), 2.43 (s, 3H, -Tol), 4.07 (t, 1H, ^3J = 12.3 Hz, Cyclohexyl), 5.41 (br s, 2H, -N*H*$_2$), 5.72 (s, 1H, -COC*H*=), 7.08 (dd, 1H, ^3J = 9.2 Hz, ^4J = 2.8 Hz, Ar), 7.38 (s, 5H, Ar), 7.91 (d, 1H, ^3J = 9.2 Hz, Ar).^{13}C NMR (300,13 MHz DMSO-d_6): δ= 20.87 (CH_3, -Tol), 24.20 (CH_2), 26.22, 30.22 ($4CH_2$), 62.55 (CH, Cyclohexyl), 106.35, 109.98, 119.95, 120.42 (4CH), 127.51, 129.19 (4CH), 129.26, 131.79, 134.54, 138.54, 144.79, 153.39, 174.69 (7C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3326 (w), 2922 (m), 2851 (w), 1584 (s), 1557 (s), 1510 (m), 1482 (s), 1446 (m), 1394 (m), 1254 (m), 1167 (m), 1113 (w), 1052 (w), 822 (s), 596 (m), 563 (m). MS (GC, 70eV): *m/z* (%) = 332 (M^+, 33), 251 (17), 250 (100), 249 (13), 55 (12). HRMS (EIHR): calcd for $C_{22}H_{24}N_2O$ 332.1883, found 332.1885.

6-Amino-1-pentyl-2-*p*-tolylquinolin-4(1*H*)-one (8ag).

Yellow crystals, yield 99%. Mp 218-219 °C. ^{1}H NMR (300, 13 MHz, DMSO-d_6): δ= 0.73 (t, 3H, -CH_3, -C_4H_8-CH_3), 1.05 (s, 4H, -C_2H_4-C_2H_2-CH_3), 1.56 (s, 2H, -CH_2- CH_2-C_3H_7), 2.41 (s, 3H, CH_3, -Tol), 3.99 (t, 2H, -CH_2-C_4H_9), 5.40 (s, 2H, NH_2), 5.74 (s, 1H, -COCH=), 7.11 (d, 1H, ^3J = 7.0 Hz, Ar), 7.36 (s, 4H, -Tol + 1H, Ar), 7.57 (d, 1H, ^3J = 9.0 Hz, Ar). ^{13}C NMR (250,13 MHz, DMSO-d_6): δ= 13.58, 20.83 ($2CH_3$), 21.33, 27.84, 27.94, 47.21 ($4CH_2$), 106.26, 109.59, 118.29, 120.88 (4CH), 128.25 (2CH), 128.39 (C), 129.08 (2CH), 131.88, 133.38, 138.57, 145.11, 152.38, 174.82 (6C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3379 (w), 3221 (m), 2921 (m), 1588 (s), 1563 (s), 1492 (s), 1414 (m), 1377 (m), 1281 (m), 1179 (m), 1019 (m), 822 (s), 558 (m). MS (GC, 70eV): *m/z* (%) = 321 (M^{+1}, 23), 320 (M^+, 100), 264 (13), 263 (78),262 (10), 250 (27), 249 (17), 248 (43), 221 (11), 207 (10), 147 (13). HRMS (ESI-TOF): calcd for $C_{21}H_{24}N_2O$ 320.1882, found 320.1889.

6-Amino-1-*n*-butyl-2-*p*-tolyl-4-quinolone (8ah).

Yellow crystals, yield 99%. Mp 206-208 °C. ^{1}H NMR (250.13 MHz, DMSO): δ = 0.69 (t, ^{3}J = 7.3 Hz, 3H, C*H*$_3$CH$_2$CH$_2$CH$_2$-), 1.08 (dd, *J* = 14.7, 7.3 Hz, 2H, CH$_3$C*H*$_2$CH$_2$CH$_2$-), 1.51 – 1.61 (m, 2H, CH$_3$CH$_2$C*H*$_2$CH$_2$-), 2.42 (s, 3H, Ar-CH3), 3.99-4.04 (m, 2H, CH$_3$CH$_2$CH$_2$C*H*$_2$-), 5.42 (s, 2H, -NH$_2$), 5.76 (s, 1H, Ar), 7.12 (dd, $^{3,4}J$ = 9.1, 2.7 Hz, 1H, Ar), 7.38 (s, 5H, Ar), 7.60 (d, ^{3}J = 9.1 Hz, 1H, Ar). ^{13}C NMR (75 MHz, DMSO) δ = 13.23 (CH$_3$), 19.00 (CH$_2$), 20.84 (CH$_3$), 30.44, 47.04 (2CH$_2$), 106.24, 109.59, 118.35, 120.91 (4CH), 128.28 (2CH), 128.38 (C), 129.10 (2CH), 131.90, 133.37, 138.59, 145.12, 152.43, 174.84 (7C). IR (ATR): $\tilde{\nu}$ = 3376 (w), 3330 (w), 3222 (w), 2951 (w), 2855 (w), 1650 (w), 1612 (w), 1587 (s), 1562 (s), 1542 (s), 1510 (m), 1492 (s), 1456 (m), 1416 (s), 1375 (m), 1328 (m), 1307 (m), 1283 (s), 1256 (m), 1231 (w), 1207 (w), 1180 (s), 1155 (w), 1109 (w), 1072 (w), 1016 (m), 935 (w), 867 (w), 852 (w), 835 (s), 824 (s), 815 (s), 789 (w), 776 (m), 738 (w), 700 (w), 688 (w), 595 (m), 555 (s), 533 (s). MS (GS): m/z (%) = 306 (M^{-1}, 100), 307 (25), 264 (15), 263 (74), 253 (10), 250 (18), 249 (18), 248 (30), 209 (11), 208 (14), 207 (24), 147 (12). HRMS (ESI): calcd for C$_{20}$H$_{23}$N$_2$O 307.18049; found: 307.18102.

6-Amino-1-*n*-propyl-2-*p*-tolyl-4-quinolone (8ai).

Pale brown crystals, yield 97%. Mp 210-212 °C. ^{1}H NMR (250.13 MHz, DMSO): δ = 0.66 (t, ^{3}J = 7.4 Hz, 3H, C*H*$_3$CH$_2$CH$_2$-), 1.60 (dd, *J* = 14.8, 7.4 Hz, 2H, CH$_3$C*H*$_2$CH$_2$-), 2.42-2.55 (m, 3H, Ar-C*H*$_3$), 3.94-3.99 (m, 2H,-NH$_2$), 5.42 (s, 2H, CH$_3$CH$_2$C*H*$_2$-), 5.76 (s, 1H, -COC*H*=), 7.12 (dd, $^{3,4}J$ = 9.1, 2.7 Hz, 1H, Ar), 7.37 – 7.39 (m, 5H, Ar), 7.60 (d, ^{3}J = 9.1 Hz, 1H, Ar). ^{13}C NMR (75 MHz, DMSO) δ = 10.57, 20.84 (2CH$_3$), 21.80, 48.80 (2CH$_2$), 106.22, 109.55, 118.39, 120.93 (4CH), 128.23 (2CH), 128.33 (C), 129.13 (2CH), 131.90, 133.40, 138.60, 145.15, 152.51, 174.87 (6C). IR (ATR): $\tilde{\nu}$ = 3428 (w), 3329 (w), 3226 (w), 2938 (w), 1622 (w), 1582 (s), 1566 (s), 1510 (w), 1483 (s), 1376 (w), 1360 (w), 1316 (w), 1281 (m), 1259 (w), 1179 (m), 1112 (w), 1070 (w), 1014 (w), 934 (w), 902 (w), 876 (w), 845 (w), 808 (s), 741 (w), 715 (w), 688 (w), 625 (w), 593 (m), 568 (m), 550 (m), 531 (m). MS (GS): m/z (%) = 292 (M^{-1}, 100), 293 (21), 264 (16), 263 (78), 250 (11), 249 (18), 248 (42), 221 (10), 147 (11). HRMS (ESI): calcd for C$_{19}$H$_{21}$N$_2$O: 293.16484; found: 293.16533.

6-Amino-1-isopropyl-2-*p*-tolylquinolin-4(1*H*)-one (8aj).

Yellow crystals, yield 85%. Mp 323-324 °C. ^{1}H NMR (300.13 MHz, DMSO-d$_6$): δ = 1.54 (d, 6H, ^{3}J = 7.1 Hz, 2C*H*$_3$, *i*-PrOH), 2.42 (s, 3H, C*H*$_3$, -Tol), 4.57 (m, 1H, C*H*, *i*-PrOH), 5.44 (br s, 2H, N*H*$_2$), 5.71 (s, 1H, -COC*H*=), 7.09 (dd, 1H, ^{3}J = 9.2 Hz, ^{4}J = 2.8 Hz, Ar), 7.38 (m, 1H, Ar + 4H, -Tol), 7.80 (d, 1H, ^{3}J = 7.1 Hz, Ar). ^{13}C NMR (300.13 MHz, DMSO) δ = 20.82 (2CH$_3$),

53.06 (CH_3, -Tol), 106.54, 109.78, 119.98, 120.19 (4CH), 127.63 (2CH), 127.72 (C), 129.32 (2CH), 129.39 (CH), 131.08, 134.43, 138.57, 144.83, 153.12, 174.70 (6C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3318 (w), 2919 (w), 1586 (s), 1568 (s), 1485 (m), 1454 (m), 1393 (m), 1373 (m), 1248 (m), 1170 (m), 1109 (m), 1076 (m), 995 (m), 824 (s), 595 (m). MS (GC, 70eV): *m/z* (%) = 293 (M^{+1}, 14), 292 (M^+, 63), 251 (28), 250 (100), 222 (22), 221 (21), 206 (13). HRMS (ESI): calcd for $C_{19}H_{20}N_2O$ 292.1570, found 292.1570.

6-Amino-1-phenyl-2-*p*-tolylquinolin-4(1*H*)-one (8ak).

Brown powder, 81% (yield of the product **8ak** obtained from the substrate **7ak**) 56% (yield of the product **8ak** obtained from the substrate **7aq**). Mp 253-255 °C. ^{1}H NMR (300.13 MHz, DMSO-d_6): δ = 2.24 (-C*H*$_3$, -Tol), 5.42 (br s, 2H, -N*H*$_2$), 5.97 (s, 1H, -COC*H*=), 6.59 (d, 1H, ^3J = 9.1 Hz, Ar), 6.92 (dd, 1H, ^3J = 2.8 Hz, ^3J = 9.1 Hz, Ar), 7.05 (d, 2H, ^3J = 8.0 Hz, -Tol), 7.19 (d, 2H, ^3J = 8.0 Hz, -Tol), 7.32-7.35 (m, 1H, Ar), 7.36-7.38 (m, 2H, Ar), 7.40 (d, 2H, ^3J = 2.8 Hz, Ar), 7.42-7.44 (m, 1H, Ar). ^{13}C NMR (300.13 MHz, DMSO) δ = 20.65 (CH_3), 105.66, 109.43, 119.01, 120.57 (4CH), 127.07 (C), 128.25 (2CH), 128.29 (C), 128.68 (CH),129.04, 129.33, 130.07 (6CH), 133.11, 134.18, 137.66, 139.24, 145.35, 151.92, 175.48 (7C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3326 (w), 1587 (s), 1568 (s), 1506 (m), 1480 (s), 1403 (m), 1373 (m), 1319 (m), 1293 (m), 1022 (m), 926 (w), 853 (m), 820 (s), 769 (m), 698 (s), 578 (m), 544 (m). MS (GC, 70eV): *m/z* (%) = 327 (M^{+1}, 22), 326 (M^+, 100), 298 (27). HRMS (ESI-TOF): calcd for $C_{22}H_{18}N_2O$ 326.1414, found 326.1409.

6-Amino-1-(3,5-dimethylphenyl)-2-*p*-tolylquinolin-4(1*H*)-one (8am).

Yellow crystals, yield 85%. Mp 332-334 °C. ^{1}H NMR (300 MHz, DMSO-d_6): δ= 2.23 (s, 6H, 2C*H*$_3$, Ar`), 2.25 (s, 3H, -C*H*$_3$, -Tol), 5.42 (s, 2H, -$NH_2$), 5.95 (s, 1H, -COC*H*=), 6.64 (d, 1H, $^3J$ = 9.1 Hz, Ar), 6.93 (dd, 1H, $^3J$ = 9.1 Hz, $^4J$ = 2.7 Hz, Ar), 6.96-7.00 (m, 3H, Ar`), 7.06 (d, 2H, ^3J = 8.0 Hz, -Tol), 7.21 (d, 2H, ^3J = 8.0 Hz, -Tol), 7.40 (d, 1H, ^4J = 2.7 Hz, Ar). ^{13}C NMR (250 MHz, DMSO-d_6): δ= 20.55, 20.68, 48.57 ($3CH_3$), 105.59, 109.44, 119.23, 120.56 (4CH), 127.06 (C), 127.49, 128.21, 128.99 (6CH), 130.03 (CH), 133.18, 134.21, 137.64 (3C), 138.53 (2C), 139.05, 145.31, 151.87, 175.43 (4C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3324 (m), 1584 (s), 1510 (m), 1478 (s), 1409 (m), 1323 9 (m), 1310 (m), 1180 (m), 1019 (m), 843 (m), 816 (m), 707 (m), 600 (m), 562 (m). MS (GC, 70eV): *m/z* (%) = 355 (M^{+1}, 29), 354 (M^+, 100), 353 (M^{-1}, 28), 115 (11). HRMS (ESI-TOF): calcd for $C_{24}H_{22}N_2O$ 354.1727, found 354.1725.

6-Amino-1-(2,3-dihydro-1*H*-inden-5-yl)-2-*p*-tolylquinolin-4(1*H*)-one (8an).

Brown powder, yield 31%. Mp 333-335 °C. ^{1}H NMR (300, 13 MHz, DMSO-d_6): δ= 0.84 (br s, 2H, Alk), 1.43 (br s, 2H, Alk), 2.39 (s, 3H, C*H*$_3$, -Tol), 3.90 (t, 2H, ^{3}J = 7.1 Hz, Alk), 5.41 (s, 2H, -N*H*$_2$), 5.73 (s, 1H, -COC*H*=), 7.10 (dd, 1H, ^{3}J = 9.1 Hz, Ar), 7.23-7.42 (m, 8H, Ar), 7.51 (d, 1H, ^{3}J = 9.1 Hz, Ar). ^{13}C NMR (300,13 MHz, DMSO-d_6): δ= 22.01 (CH_3), 26.92, 30.67, 53.12 ($3CH_2$), 111.50, 121.98 (2CH), 122.57 (CH + CF_3COOD), 122.82 (CH), 123.38, 123.76 (2C), 129.40 (2CH), 129.51, 129.54 (2CH), 131.76 (2CH), 132.06 (C), 132.31 (CH), 141.49, 144.20, 159.84, 161.72, 163.15, 164.08, 170.39 (7C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3322 (w), 2938 (w), 1586 (s), 1568 (s), 1485 (s), 1470 (s), 1380 (m), 1283 (m), 1259 (m), 1176 (m), 1017 (m), 933 (w), 811 (s), 553 (m), 531 (m). HRMS (ESI-TOF): calcd for $C_{25}H_{22}N_2O$ 366.4508, found 366,4485.

6-Amino-1-(4-methoxyphenyl)-2-*p*-tolylquinolin-4(1*H*)-one (8ap).

Yellow powder, yield 85%. Mp 228-230 °C. ^{1}H NMR (500,13 MHz, DMSO-d_6): δ= 2.24 (s, 3H, -C*H*$_3$, -Tol), 3.76 (s, 3H, -OC*H*$_3$), 5.37 (br s, NH_2), 5.98 (s, 1H, -COC*H*=), 6.62 (d, 1H, ^{3}J = 9.0 Hz, Ar), 6.93 (d, 2H, ^{3}J = 8.9 Hz, -Tol), 6.94 (d, 1H, ^{3}J = 9.0 Hz, Ar), 7.06 (d, 2H, ^{3}J = 7.9 Hz, Ar`), 7.18 (d, 2H, $^{3}J$ = 7.9 Hz, Ar`), 7.24 (d, 2H, ^{3}J = 8.9 Hz, -Tol), 7.41 (d, 1H, ^{4}J = 2.7 Hz, Ar). ^{13}C NMR (300,13 MHz, DMSO-d_6): δ= 20.68, 55.26 ($2CH_3$), 105.67, 109.43 (2CH), 114.38 (2CH), 119.13, 120.61 (2CH), 127.14 (C), 128.31, 129.03, 131.08 (6CH), 131.90, 133.30, 134.63, 137.61, 145.34, 152.30, 158.70, 175.51 (8C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 2918 (w), 1588 (s), 1568 (s), 1505 (s), 1481 (s), 1393 (m), 1361 (m), 1295 (m), 1245 (s), 1107 (m), 1023 (m), 818 (s), 546 (m). MS (GC, 70eV): *m/z* (%) = 357 (M^{+1}, 29), 356 (M^{+}, 100), 355 (M^{-1}, 13), 328 (12), 197 (10). HRMS (ESI-TOF): calcd for $C_{23}H_{20}N_2O_2$ 356.1519, found 356.1525.

6-Amino-1-(3,4-dimethoxyphenethyl)-2-phenylquinolin-4(1*H*)-one (8ba).

Yellow crystals, yield 81%. Mp 217-219 °C. ^{1}H NMR (300,13 MHz DMSO-d_6): δ= 2.81 (t, 2H, ^{3}J = 7.2 Hz, -C*H*$_2$-Ar), 3.58 (s, 3H, -OC*H*$_3$), 3.71 (s, 3H, -OC*H*$_3$), 4.19 (t, 2H, ^{3}J = 7.2 Hz, -C*H*$_2$-CH_2Ar), 5.49 (br s, 2H, -N*H*$_2$), 5.75 (s, 1H, COC*H*=), 6.27 (d, 1H, ^{4}J = 1.8 Hz, Ar`), 6.34 (dd, 1H, $^{3}J$ = 8.1 Hz, $^{4}J$ = 1.8 Hz, Ar`), 6.76 (d, 1H, ^{3}J = 8.1 Hz, Ar`), 7.21 (dd, 1H, ^{3}J = 9.1 Hz, ^{4}J = 2.8 Hz, Ar), 7.30 (m, 2H, Ph), 7.44 (d, 1H, ^{4}J = 2.8 Hz, Ar), 7.52 (m, 3H, Ph), 7.79 (d, 1H, ^{3}J = 9.1 Hz, Ar). ^{13}C NMR (250.13 MHz, DMSO-d_6): δ = 33.86, 49.07 ($2CH_2$), 55.20, 55.52 (2 OCH_3), 106.30, 109.46, 111.82, 112.10, 118.49, 120.47, 121.13 (7CH), 128.32 (2CH, Ph), 128.36 (C), 128.38 (2CH, Ph), 128.96 (CH, Ph), 129.88, 131.76, 136.03, 145.24, 147.53, 148.59, 152.41, 174.93 (8C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3383 (w), 3310 (w), 3216 (w), 2953 (w), 1633 (w),

1589 (s), 1564 (s), 1489 (s). 1418 (m), 1311 (m), 1235 (s), 1177 (m), 1153 (s), 1028 (s), 938 (m), 883 (w), 807 (s), 754 (s), 706 (s), 623 (m), 543 (m). MS (GC, 70eV): *m/z* (%) = 400 (M^+, 28), 250 (15), 249 (100), 248 (16). HRMS (ESI): calcd for $C_{25}H_{24}N_2O_3$ 400.1778, found 400.1787.

6-Amino-1-phenethyl-2-phenylquinolin-4(1*H*)-one (8bc).

Yellow crystals, yield 99%. Mp 253-254 °C. ^{1}H NMR (300,13 MHz, DMSO-d_6): δ= 2.90 (t, 2H, ^3J = 7.5 Hz, -CH_2-CH_2-, Ar`), 4.20 (t, 2H, $^3J$ = 7.5 Hz, -C$H_2$-$CH_2$-, Ar`), 5.47 (s, 2H, -NH_2), 5.74 (s, 1H, -COC*H*=), 6.80-6.87 (m, 2H, Ar), 7.15-7.25 (m, 4H, Ar), 7.30-7.37 (m, 2H, Ar), 7.43 (d, 1H, ^4J = 2.7 Hz, Ar), 7.49-7.56 (m, 3H, Ar), 7.78 (d, 1H, ^3J = 9.1 Hz, Ar). ^{13}C NMR (0.13 MHz, DMSO-d_6): δ = 34.30, 48.82 ($2CH_2$), 106.37, 109.53, 118.41, 121.13, 126.54 (5CH), 128.32, 128.39, 128.48, 128.53 (8CH, C), 129.06 (CH), 131.72, 135.99, 137.54, 145.26, 152.36, 174.90 (6C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3368 (w), 1583 (s), 1488 (s), 1420 (m), 1371 (w), 1311 (m), 1177 (m), 1073 (w), 810 (m), 757 (m), 702 (s). MS (GC, 70eV): *m/z* (%) = 341 (M^{+1}, 12), 340 (M^+, 48), 250 (17), 249 (100), 248 (21). HRMS (ESI): calcd for $C_{23}H_{20}N_2O$ 340.1571, found 340.1576.

6-Amino-1-phenethyl-2-phenylquinolin-4(1*H*)-one (8bd).

Yellow crystals, yield 99%. Mp 223-225 °C. ^{1}H NMR (300,13 MHz, $CDCl_3$/DMSO-d_6 9:1): δ= 1.92 (p, 2H, ^3J = 7.5 Hz, -CH_2-CH_2- CH_2-Ph), 2.36-2.45 (m, 2H, -C_2H_4- CH_2-Ph), 3.30 (br s, NH_2 + H_2O) 3.94 (t, 2H, ^3J = 7.8 Hz, -CH_2- C_2H_4-Ph), 5.98 (s, 1H, -COC*H*=), 6.90-7.61 (m, 13H, Ar). ^{13}C NMR (300.13 MHz, $CDCl_3$/DMSO-d_6 9:1): δ = 29.47, 31.87, 46.81 ($3CH_2$), 107.56, 110.14, 117.01, 121.04, 125.58 (5CH), 127.52, 127.59, 127.86 (6CH), 127.93 (C), 128.10 (2CH), 128.69 (CH), 132.45, 135.43, 139.46, 143.57, 152.36, 175.65. IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3225 (w), 1562 (s), 1489 (s), 1417 (m), 1369 (m), 1283 (m), 1186 (m), 838 (s), 741 (m), 698 (s), 561 (m). MS (GC, 70eV): *m/z* (%) = 355 (M^{+1}, 27), 354 (M^+, 100), 250 (12), 249 (82), 248 (19), 236 (16), 235 (10), 147 (10), 91 (38). HRMS (ESI-TOF): calcd for $C_{24}H_{22}N_2O$ 354.1721, found 354.1732.

6-Amino-1-heptyl-2-phenylquinolin-4(1*H*)-one (8be).

Yellow crystals, yield 75%. Mp 178-180 °C. ^{1}H NMR (300,13 MHz DMSO-d_6): δ= 0.81 (t, 3H, ^3J = 6.9 Hz, -CH_3), 0.99-1.29 (m, 8H, -$(CH_2)_2$(CH_2)$_4$$CH_3$), 1.57 (br s, 2H, -$CH_2$-C$H_2$-$C_5H_{11}$), 3.26-3.66 (br s, 2H, -NH_2+H_2O), 4.00 (t, 2H, ^3J = 7.1 Hz, -CH_2-C_6H_{13}), 5.79 (s, 1H, -COC*H*=),

7.13 (d, 1H, ^{3}J = 7.1 Hz, Ar), 7.39 (d, 1H, ^{4}J = 1.8 Hz, Ar), 7.47-7.67 (m, 1H, Ar + 5H, Ph). ^{13}C NMR (250.13 MHz, DMSO-d_6): δ = 13.78 (CH_3), 21.85, 25.55, 27.70, 28.14, 30.82, 47.25 ($6CH_2$), 106.22, 109.50, 118.30, 121.04 (4CH), 128.35 (C + 2CH, Ph), 128.55 (2CH, Ph), 129.07 (CH, Ph), 131.89, 136.14, 145.19, 152.27, 174.82 (5C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3387 (w), 3328 (w), 3222 (m), 3061 (w), 2918 (m), 2852 (m), 1643 (w), 1605 (m), 1585 (s), 1558 (s), 1538 (s), 1489 (s), 1440 (m), 1415 (s), 1376 (m), 1328 (m), 1307 (m), 1282 (s), 1254 (m), 1229 (m), 1153 (m), 1116 (m), 1073 (m), 1020 (m), 938 (m), 868 (m), 837 (s), 815 (s), 787 (m), 758 (m), 721 (m), 702 (s), 662 (m), 623 (m), 558 (s), 538 (s). MS (GC, 70eV): *m/z* (%) = 335 (M^{+1}, 33), 334 (M^{+}, 100), 250 (18.39), 249 (89), 236 (34), 235 (14), 41 (10). HRMS (ESI): calcd for $C_{22}H_{26}N_2O$ 334.2039, found 334.2045.

6-Amino-1-cyclohexyl-2-phenylquinolin-4(1*H*)-one (8bf)

Yellow crystals, yield 99%. Mp 261-263 °C. ^{1}H NMR (300.13 MHz, DMSO-d_6): δ= 0.86 (q, 2H, ^{3}J = 12.6 Hz, Cyclohexyl), 1.26 (q, 1H, ^{3}J = 12.8 Hz, Cyclohexyl), 1.51 (d, 1H, ^{3}J = 12.7 Hz, Cyclohexyl),1.78 (t, 4H, ^{3}J = 12.4 Hz, Cyclohexyl), 2.40 (q, 2H, ^{3}J = 12.1 Hz, Cyclohexyl),4.02 (t, 1H, ^{3}J = 12.6 Hz, Cyclohexyl), 5.42 (s, 2H, -NH_2), 5.74 (s, 1H, -COCH=), 7.09 (dd, 1H, ^{3}J = 9.2 Hz, ^{4}J = 2.9 Hz, Ar), 7.40 (d, 1H, ^{4}J = 2.9 Hz, Ar), 7.43-7.70 (m, 5H, -Ph), 7.91 (d, 1H, ^{3}J = 9.2 Hz, Ar). ^{13}C NMR (300.13 MHz, DMSO-d_6 9:1): δ = 24.19 (CH_2), 26.23, 30.18 ($4CH_2$), 62.62, 106.35, 109.84, 120.00, 120.41 (5CH), 127.60, 128.66 (4CH), 129.08 (CH), 129.19, 131.74, 137.34, 144.84, 153.24, 174.68 (6C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3314 (w), 2939 (w), 1583 (s), 1486 (s), 1402 (m), 1348 (m), 1260 (m), 1167 (m), 1053 (m), 779(s), 702 (s), 565 (m). MS (GC, 70eV): *m/z* (%) = 318 (M^{+}, 23), 237 (18), 236 (100), 235 (9), 208 (10), 41 (8). HRMS (ESI-TOF): calcd for $C_{21}H_{22}N_2O$ 318.1726, found 318.1732.

6-Amino-1-hexyl-2-phenylquinolin-4(1*H*)-one (8bg).

Yellow crystals, yield 80%. Mp 197-199 °C. ^{1}H NMR (300.13 MHz, DMSO-d_6): δ= 0.77 (t, 3H, ^{3}J = 7.0 Hz, -$(CH_2)_5$-C*H*$_3$), 0.96-1.11 (m, 6H, -$(CH_2)_2$-(C*H*$_2$)$_3$-CH_3), 1.57 (br s, 2H, -CH_2-C*H*$_2$-C_4H_9), 3.98 (t, 2H, ^{3}J = 7.2 Hz, -C*H*$_2$-C_5H_{11}), 5.43 (s, 2H, -N*H*$_2$), 5.78 (s, 1H, -COC*H*=), 7.13 (dd, 1H, ^{3}J = 9.0 Hz, ^{4}J = 2.2 Hz, Ar), 7.39 (d, 1H, ^{4}J = 2.2 Hz, Ar), 7.49-7.61 (m, 1H, Ar + 5H, Ph). ^{13}C NMR (300.13 MHz, DMSO-d_6): δ = 13.68 (-CH_3), 21.71, 25.27, 28.12, 30.25, 47.22 ($5CH_2$), 106.25, 109.50, 118.30, 120.95 (4CH), 128.37, 128.57 (4CH, -Tol), 129.07 (CH, -Tol), 131.87, 136.17, 145.16, 152.25 (4C), 174.83 (-CO-). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3222 (w), 2916 (w),

1558 (s), 1489 (s), 1416 (m), 1376 (m), 1283 (m), 1178 (m), 837 (s), 760 (m), 702 (s), 558 (m). MS (GC, 70eV): *m/z* (%) = 321 (M^{+1}, 24), 320 (M^{+}, 100), 250 (14), 249 (77), 248 (17).

HRMS (ESI-TOF): calcd for $C_{21}H_{24}N_2O$ 320.1882, found 320.1889.

6-Amino-2-butyl-1-(3,4-dimethoxyphenethyl)quinolin-4(1*H*)-one (8ca).

Brown oil, yield 99%. ^{1}H NMR (300.13 MHz, DMSO-d_6): δ= 0.91 (t, 3H, ^3J = 7.2 Hz, -$(CH_2)_3$-CH_3), 1.30-1.40 (m, 2H, -$(CH_2)_2$-CH_2- CH_3), 1.52 (p, 2H, ^3J = 7.2 Hz, -CH_2-CH_2-C_2H_5), 2.44 (t, 2H, ^3J = 7.5 Hz, -CH_2-C_3H_7), 2.96 (t, 2H, ^3J = 6.0 Hz, -CH_2-CH_2-Ar`), 3.71 (s, 3H, -OC$H_3$), 3.75 (s, 3H, -OC$H_3$), 4.36 (br s, 2H, -C$H_2$-$CH_2$-Ar`), 5.35 (br s, 2H, -NH_2), 5.82 (s, 1H, -COC*H*=), 6.69-6.79 (m, 2H, Ar`), 6.90 (d, 1H, $^3J$ = 7.9 Hz, Ar`), 7.12 (dd, 1H, ^3J = 9.1 Hz, ^4J = 2.7 Hz, Ar), 7.36 (d, 1H, ^4J = 2.7 Hz, Ar), 7.68 (d, 1H, ^3J = 9.1 Hz, Ar). ^{13}C NMR (300 MHz, DMSO-d_6): δ = 13.55 (-$(CH_2)_3$-*C*H_3), 21.87, 30.38, 32.41, 33.93, 46.82 (5CH_2), 55.34, 55.53 (2 OCH_3), 106.48, 107.84, 111.96, 112.72, 117.83, 120.73, 120.79 (7CH), 127.98, 130.30, 132.17, 144.74, 147.65, 148.69, 152.89, 175.28. IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3325 (w), 3211 (w), 2929 (w), 1587 (s), 1481 (s), 1362 (w), 1323 (w), 1235 (s), 1139 (m), 1024 (s), 808 (m), 761 (m), 557 (m). MS (GC, 70eV): *m/z* (%) = 381 (M^{+1}, 15), 380 (M^{+}, 55), 379 (M^{-1}, 14), 230 (16), 229 (100), 214 (12), 174 (11), 159 (12), 151 (18). HRMS (ESI-TOF): calcd for $C_{23}H_{28}N_2O_3$ 380.2091, found 380.2099.

6-Amino-1-(3,4-dimethoxyphenethyl)-2-pentylquinolin-4(1*H*)-one (8da).

Brown oil, yield 98%. ^{1}H NMR (300.13 MHz, DMSO-d_6): δ= 0.89 (t, 3H, ^3J = 7.2 Hz, -$(CH_2)_4$-CH_3), 1.28-1.34 (m, 4H, -$(CH_2)_2$-$(CH_2)_2$-CH_3), 1.53 (br s, 2H, -CH_2-CH_2-C_3H_7), 2.43 (t, 2H, ^3J = 7.5 Hz, -CH_2-C_4H_9), 2.96 (t, 2H, ^3J = 6.4 Hz, -CH_2-CH_2-Ar`), 3.71 (s, 3H, -OC$H_3$), 3.75 (s, 3H, -OC$H_3$), 4.36 (br s, 2H, -C$H_2$-$CH_2$-Ar`), 5.35 (br s, 2H, -NH_2), 5.82 (s, 1H, -COC*H*=), 6.69-6.79 (m, 2H, Ar`), 6.89 (d, 1H, $^3J$ = 7.9 Hz, Ar`), 7.12 (dd, 1H, ^3J = 9.1 Hz, ^4J = 2.7 Hz, Ar), 7.36 (d, 1H, ^4J = 2.7 Hz, Ar), 7.68 (d, 1H, ^3J = 9.1 Hz, Ar). ^{13}C NMR (300 MHz, DMSO-d_6): δ = 13.82 (-$(CH_2)_3$-*C*H_3), 21.75, 27.91, 30.91, 32.65, 33.93, 46.80 (6CH_2), 55.32, 55.52 (2 OCH_3), 106.48, 107.81, 111.93, 112.71, 117.83, 120.73, 120.79 (7CH), 127.98, 130.30, 132.16, 144.74, 147.65, 148.69, 152.88, 175.28. IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3328 (w), 3213 (w), 2928 (w), 1588 (s), 1482 (s), 1362 (w), 1323 (w), 1235 (s), 1139 (m), 1024 (s), 808 (m), 761 (m), 557 (m). MS (GC, 70eV): *m/z* (%) = 395 (M^{+1}, 19), 394 (M^{+}, 47), 281 (18), 267 (13), 244 (11), 243 (100), 237 (11), 228 (20), 208 (12), 188 (13), 187 (28), 175 (10), 174 (10), 165 (13), 164 (22), 160 (11), 159

(19), 151 (31), 133 (12), 107 (11), 106 (11), 105 (17), 103 (15), 79 (19), 77 (17), 73 (11). HRMS (ESI-TOF): calcd for $C_{24}H_{30}N_2O_3$ 394.2245, found 394.2256.

6-Amino-1-(4-methoxybenzyl)-2-pentylquinolin-4(1*H*)-one (8db).

Beige crystals, yield 99%. Mp 201-202 °C. ^{1}H NMR (300.13 MHz, DMSO-d_6): δ= 0.86 (t, 3H, ^3J = 7.0 Hz, -C_4H_8-C*H*$_3$), 1.19-1.39 (m, 4H, -C_2H_4-C_2H_4-CH_3), 1.60 (p, 2H, ^3J = 7.7 Hz, -CH_2-C*H*$_2$-C_3H_7), 2.67 (t, 2H, ^3J = 7.7 Hz, -C*H*$_2$-C_4H_9), 3.73 (s, 3H, -OC*H*$_3$), 5.30 (s, 2H, -N*H*$_2$), 5.42 (s, 2H, -C*H*$_2$-Ar`), 5.98 (s, 1H, -COCH=), 6.86-7.04 (m, 5H, 1H, Ar + 4H, Ar`), 7.25-7.38 (m, 2H, Ar). ^{13}C NMR (300.13 MHz, DMSO-d_6): δ= 13.74 (-C_4H_8-*C*H_3), 21.76, 28.07, 30.74, 32.95, 48.15 (5CH), 55.01(-OCH_3), 106.20, 108.18 (2CH), 114.18 (2CH), 118.20, 120.47 (2CH), 126.65 (2CH), 127.87, 128.88, 132.79, 144.79, 153.01, 158.34, 175.47 (7C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3320 (w), 2951 (w), 1587 (s), 1564 (s), 1486 (s), 1366 (m), 1244 (m), 1174 (s), 1106 (m), 1027 (m), 818 (s), 622 (m), 555 (s). MS (GC, 70eV): *m/z* (%) =350 (M^+, 11), 292 (8), 174 (16), 121 (100). HRMS (ESI-TOF): calcd for $C_{22}H_{26}N_2O_2$ 350.1988, found 350.1994

Specific procedure for the synthesis of 9a and 9b.

Under a constant flow of an inert gas a pressure tube was charged with a magnetic stirrer, **6a** (450 mg, 1 equiv.), KF (2 equiv.), extra dry dimethylformamide (6 ml) and appropriate amine **(**1.7 equiv.). After stirring for 10 h at 120 °C the solvent was evaporated under reduced pressure. Residue was purified by a column chromatography (silica gel, heptane / ethyl acetate, 25:1). On the TLC compound **9** appears as an upper spot ($R_f \approx 0.8$) in comparison to **7** ($R_f \approx 0.4$).

Specific procedure for the synthesis of 9c and 10a.

Under a constant flow of an inert gas a pressure tube was charged with a magnetic stirrer, **6c** (450 mg, 1 equiv.), KF (2 equiv.), extra dry dimethylformamide (6 ml) and 2-(3,4-dimethoxyphenyl)ethanamine (1.7 equiv.). After stirring for 4 h at 120 °C the solvent was evaporated under reduced pressure. Residue was purified by a column chromatography (silica gel, heptane / ethyl acetate, 25:1). On the TLC compound **9** and **10** appear as upper spots ($R_f \approx$ 0.8 for **9**, $R_f \approx 0.75$ for **10**) in comparison to **7** ($R_f \approx 0.4$).

Specific procedure for the synthesis of 9d and 10b.

Under a constant flow of an inert gas a pressure tube was charged with a magnetic stirrer, **6c** (450 mg, 1 equiv.), KF (2 equiv.), extra dry dimethylformamide (6 ml) and cyclohexylamine (1.7 equiv.). After stirring for 4 h at 120 °C the solvent was evaporated under reduced pressure. Residue was purified by a column chromatography (silica gel, heptane / ethyl acetate, 25:1)

(*Z*)-3-(4-Methoxybenzylamino)-1-(2-(4-methoxybenzylamino)-5-nitrophenyl)-3-*p*-tolylprop-2-en-1-one (9a).

Yellow crystals, yield 8%. Mp 166-167 °C. ^{1}H NMR (300 MHz, $CDCl_3$) δ = 2.42 (s, 3H, CH_3), 3.80 (s, s, 6H, 2 OCH_3), 4.41 (d, d, 6.0 Hz, 4H, 2 CH_2), 5.79 (s, 1H, -CH=C), 6.59 (d, *J* = 9.4 Hz, 1H, Ar), 6.85 – 6.90 (m, 4H, Ar), 7.13 – 7.16 (m, 2H, Ar), 7.25 – 7.33 (m, 6H, Ar), 8.05 (dd, *J* = 9.3, 2.5 Hz, 1H, Ar), 8.58 (d, *J* = 2.6 Hz, 1H, Ar), 9.88 (t, *J* = 5.5 Hz, 1H, NH), 11.28 (t, *J* = 6.1 Hz, 1H, NH). ^{13}C NMR (300 MHz, $CDCl_3$) δ = 21.34 (CH_3), 46.43, 48.08 (CH_2), 55.25, 94.20, 110.94, 114.16 (d, *J* = 4.9 Hz), 119.48, 126.32, 127.63, 128.40 – 127.75 (m), 129.38 (d, *J* = 10.8 Hz), 130.26, 132.26, 135.74, 139.97, 154.34, 158.97 (d, *J* = 1.7 Hz), 167.26, 189.67. IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3225 (w), 2838 (w), 1609 (m), 1576 (m), 1556 (m), 1514 (s), 1494 (m), 1456 (m), 1428 (w), 1369 (w), 1324 (s), 1303 (m), 1278 (m), 1253 (s), 1200 (m), 1176 (m), 1140 (m), 1106 (s), 1078 (m), 1020 (m), 927 (w), 911 (m), 848 (w), 819 (s), 806 (m), 786 (m), 762 (m), 739 (s), 723 (w), 712 (w), 690 (m), 666 (w), 651 (m), 631 (m), 611 (w), 557 (w), 550 (w). MS (GC, 70eV): *m/z* (%) = 537 (M^+, 2), 417 (34), 416 (100), 283 (61), 121 (88). HRMS (EI): calcd for $C_{32}H_{32}N_3O_5$ 538.2336, found 538.2343.

(*Z*)-3-(Isopropylamino)-1-(2-(isopropylamino)-5-nitrophenyl)-3-*p*-tolylprop-2-en-1-one (9b).

Brown oil, yield 7%. ^{1}H NMR (250 MHz, $CDCl_3$) δ = 1.22 (d, *J* = 6.5 Hz, 6H, $CH(CH_3)_2$), 1.34 (d, *J* = 6.4 Hz, 6H, $CH(CH_3)_2$), 2.42 (s, 3H, CH_3), 3.60 – 3.86 (m, 2H, $CH(CH_3)_2$), 5.61 (s, 1H, -CH=C), 6.61 (d, *J* = 9.5 Hz, 1H, Ar), 7.26 – 7.28 (m, 4H, Tolyl), 8.08 (dd, *J* = 9.4, 2.6 Hz, 1H, Ar), 8.52 (d, *J* = 2.6 Hz, 1H, Ar), 9.51 (d, *J* = 7.1 Hz, 1H, NH), 10.88 (d, *J* = 9.3 Hz, 1H, NH). ^{13}C NMR (250 MHz, CDCl3) δ = 21.34, 22.52, 24.19, 43.89, 46.31 (5 CH_3), 93.73, 110.52 (CH), 119.07 (C), 126.73, 127.33, 127.95, 129.26 (CH), 132.98, 134.94, 139.61, 153.60, 166.33, 189.50 (C). IR (ATR, cm^{-1}): $\tilde{\nu}$ =2930 (w), 1596 (s), 1572 (s), 1520 (s), 1475 (m), 1315 (s), 1241 (m), 1142 (m),1137 (m), 1060 (m), 922 (w), 896 (w), 860 (w), 739 (s), 651 (w), 577 (w). HRMS (EI): calcd for $C_{22}H_{27}N_3O_3$ 381,4724, found 381,4731.

(*Z*)-3-(3,4-Dimethoxyphenethylamino)-1-(2-(3,4-dimethoxyphenethylamino)-5-nitrophenyl)hept-2-en-1-one (9c).

Brown oil, yield 9%. ^{1}H NMR (300 MHz, $CDCl_3$) δ = 0.94 (t, ^{3}J = 7.2 Hz, 3H, -$(CH_2)_3CH_3$), 1.36 – 1.57 (m, 4H, -$(CH_2)_3CH_3$), 2.22 (t, ^{3}J = 7.62, 2H, -$(CH_2)_3CH_3$), 2.91 (dt, ^{3}J = 14.6, ^{3}J = 7.2 Hz, 4H, 2(-NHCH_2CH_2-)), 3.45 – 3.60 (m, 4H, 2(-NHCH$_2$CH_2-)), 3.85 (s, 12H, -OCH_3), 5.59 (s, 1H, -CH=), 6.60 (d, ^{3}J = 9.4 Hz, 1H, Ar), 6.75 – 6.84 (m, 6H, Ph), 8.10 (dd, ^{3}J = 9.3 Hz, ^{4}J = 2.6 Hz, 1H, Ar), 8.52 (d, ^{4}J = 2.6 Hz, 1H, Ar), 9.52 (t, ^{3}J = 5.2 Hz, 1H,NH), 11.21 (t, ^{3}J = 5.8 Hz, 1H, NH). ^{13}C NMR (75 MHz, $CDCl_3$) δ = 13.80 (CH_3), 22.70, 30.41, 32.45, 35.00, 36.56, 44.85, 45.05 (7CH_2), 55.83, 55.92 (4CH3), 91.84, 110.20, 111.45, 111.47, 112.19, 112.22 (6CH), 119.59 (C), 120.68, 120.78, 126.09, 127.83 (4CH), 130.70, 131.35, 135.51, 147.81, 147.97, 148.99, 149.05, 154.19, 169.32, 189.04 (10C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 2931 (w), 1602 (m), 1574 (m), 1513 (s), 1463 (m), 1417 (w), 1318 (m), 1258 (s), 1233 (s), 1139 (s), 1123 (s), 1023 (s), 914 (w), 804 (m), 762 (m), 747 (m), 635 (w). MS (GC, 70eV): *m/z* (%) = 591 (M^{-1}, 2), 441 (24), 440 (88), 281 (13), 208 (10), 207 (46), 169 (20), 166 (14), 165 (100), 164 (42), 152 (22), 151 (75), 150 (15), 131 (13), 119 (13), 107 (16), 105 (18), 103 (10), 98 (12), 97 (16), 91 (21), 85 (10), 84 (15), 83 (15), 82 (13), 81 (25), 80 (12), 79 (23), 78 (15), 77 (20), 73 (26), 71 (13), 70 (13), 69 (49), 68 (15), 67 (16), 66 (11), 65 (12), 64 (10), 60 (42), 57 (25), 56 (21), 55 (40), 54 (14), 53 (12), 52 (18), 51 (14), 50 (10), 48 (10), 46 (29). HRMS (ESI): calcd for $C_{33}H_{42}N_3O_7$: 592.3017; found: 592.3018.

(*Z*)-3-(Cyclohexylamino)-1-(2-(cyclohexylamino)-5-nitrophenyl)hept-2-en-1-one (9d).

Brown oil, yield 36%. ^{1}H NMR (500 MHz, $CDCl_3$) δ = 0.98 (t, ^{3}J = 7.3 Hz, 3H, CH_3), 1.37 – 1.47 (m, 11H, Cyclohexyl), 1.59 – 1.64 (m, 5H, Cyclohexyl), 1.79 – 1.83 (m, 4H, Cyclohexyl), 1.92 – 1.94 (d, m, 2H, -$CH_2CH_2CH_2CH_3$), 2.03 – 2.04 (m, 2H, -$CH_2CH_2CH_2CH_3$), 2.30 – 2.34 (m, 2H, -$CH_2CH_2CH_2CH_3$), 3.42 – 3.46 (m, 2H, Cyclohexyl), 5.55 (s, 1H, -CH=C), 6.58 (d, *J* = 9.7 Hz, 1H, Ar), 8.05 (dd, ^{3}J = 9.4 Hz, ^{4}J = 2.7 Hz, 1H, Ar), 8.52 (d, ^{4}J = 2.7 Hz, 1H, Ar), 9.50 (d, *J* = 7.2 Hz, 1H, NH), 11.19 (d, *J* = 8.8 Hz, 1H, NH). ^{13}C NMR (500 MHz, $CDCl_3$) δ = 13.83 (CH_3), 22.75, 24.69, 25.27, 25.69, 31.23, 32.40, 32.57, 34.28 (13 CH_2), 51.12, 51.88, 91.48, 110.37 (4 CH), 119.47 (C), 126.47, 127.67 (2 CH), 134.85, 153.50, 168.08, 188.96 (4 C). IR (ATR): $\tilde{\nu}$ = 2926 (m), 2852 (w), 1598 (s), 1570 (s), 1522 (m), 1489 (m), 1448 (w), 1310 (s), 1256 (s), 1206 (m), 1150 (m), 1121 (s), 1097 (s), 921 (w), 888 (w), 816 (m), 747 (m), 718 (m), 650 (m). MS (GS): m/z (%) = 427 (M^{+}, 34), 410 (23), 345 (23), 344 (100), 327 (13), 326 (50), 302 (12), 245 (37), 203 (10), 180 (20), 165 (11), 84 (11), 55 (34), 41 (19). HRMS (ESI): calcd for $C_{25}H_{37}O_3N_3$: 427.2829; found: 427.2827.

(*Z*)-1-(2-Chloro-5-nitrophenyl)-3-(3,4-dimethoxyphenethylamino)hept-2-en-1-one (10a).

Brown oil, yield 39%. ^{1}H NMR (300.13 MHz, DMSO-d$_6$): δ= 0.92 (t, 3H, ^{3}J = 7.2 Hz, -C*H*$_3$, -*n*-But), 1.33-1.38 (m, 2H, -C*H*$_2$-, -*n*-But), 1.44-1.52 (m, 2H, -C*H*$_2$-, -*n*-But), 2.13-2.21 (m, 2H, -C*H*$_2$-, -*n*-But), 2.89 (t, 3H, -C*H*$_2$-, R$_1$), 2.99 (3H, -OC*H*$_3$), 3.51-3.58 (m, 3H, -C*H*$_2$-, R$_1$), 3.82-3.86 (m, 3H, -OC*H*$_3$), 5.32 (s, 1H, -C*H*=), 6.73-6.82 (m, 4H, Ar), 8.06 (dd, 1H, Ar), 8.23 (d, 1H, Ar), 11.29 (br s, 1H, N). ^{13}C NMR (500 MHz, CDCl$_3$) δ = 13.71 (CH$_3$), 22.54, 29.95, 31.82, 36.34 (4CH$_2$), 42.60 (CH$_3$), 44.88 (CH$_2$), 55.86 (CH$_3$), 94.13, 111.38, 112.12, 113.95, 120.79, 125.51, 126.51 (7CH), 129.37, 130.72, 137.25, 147.87, 148.98, 153.87, 169.25, 190.15 (8C).
MS (GC, 70eV): *m/z* (%) =447 (M$^+$, 31), 411 (58), 231 (16).

(*Z*)-1-(2-Chloro-5-nitrophenyl)-3-(cyclohexylamino) hept-2-en-1-one (10b).

Brown oil, yield 12%. ^{1}H NMR (500 MHz, CDCl$_3$) δ = 0.95 (t, ^{3}J = 7.3 Hz, 3H, CH$_3$), 1.37 – 1.47 (m, 6H, Cyclohexyl), 1.56 – 1.63 (m, 3H, Cyclohexyl), 1.81 – 1.84 (m, 2H, -CH$_2$CH$_2$CH$_2$-), 1.92 – 1.94 (m, 2H, -CH$_2$CH$_2$CH$_2$-), 2.30 – 2.33 (m, 2H, -CH$_2$CH$_2$CH$_2$-), 3.47 – 3.53 (m, 1H, Cyclohexyl), 5.23 (s, 1H, -CH=C), 7.51 (d, ^{3}J = 8.7 Hz, 1H, Ar), 8.08 (dd, ^{3}J = 8.7 Hz, ^{4}J = 2.8 Hz, 1H, Ar), 8.33 (d, ^{4}J = 2.7 Hz, 1H, Ar), 11.45 (d, *J* = 8.1 Hz, 1H, NH). ^{13}C NMR (500 MHz, CDCl$_3$) δ = 13.79 (CH$_3$), 22.61, 24.48, 25.21, 30.62, 31.73, 33.96 (8 CH$_2$), 51.95, 94.32, 123.94, 124.49, 131.05 (5 CH), 137.85, 142.82, 146.34, 169.08, 184.68. IR (ATR): $\tilde{\nu}$ = 2928 (w), 2854 (w), 1591 (s), 1573 (s), 1519 (s), 1451 (w), 1401 (w), 1336 (s), 1247 (m), 1189 (w), 1151 (w), 1122 (m), 1097 (m), 1040 (m), 917 (w), 890 (w), 866 (w), 831 (m), 739 (s), 650 (w), 578 (w), 532 (w). MS (GS): m/z (%) = 366 (M$^+$, C$_{19}$H$_{25}$O$_3$N$_2$^{37}Cl, 10), 364 (M$^+$, C$_{19}$H$_{25}$O$_3$N$_2$^{35}Cl, 29), 335 (12), 322 (24), 307 (13), 294 (23), 287 (26), 283 (25), 253 (14), 243 (34), 241 (100), 215 (12), 213 (36), 186 (25), 184 (76), 180 (39), 139 (10), 138 (48), 126 (10), 124 (23), 83 (11), 82 (15), 81 (11), 67 (16), 55 (50), 41 (37). HRMS (ESI): calcd for C$_{19}$H$_{25}$O$_3$N$_2$^{35}Cl: 364.1548; found: 364.1544; C$_{19}$H$_{25}$O$_3$N$_2$^{37}Cl: 366.1518; found: 366.1521.

General procedure for the synthesis of 11.

Under a constant flow of an inert gas a pressure tube was charged with a magnetic stirrer, **6a** (450 mg, 1 equiv.), K$_3$PO$_4$ (2 equiv.), extra dry dimethylformamide (6 ml) and methylaniline (1.7 equiv.). After stirring for 8 h at 120 °C the solvent was evaporated under reduced pressure. Residue was purified by a column chromatography (silica gel, heptane / ethyl acetate, 25:1).

(*Z*)-1-(2-Chloro-5-nitrophenyl)-3-(methyl(phenyl)amino)-3-*p*-tolylprop-2-en-1-one (11).

Brown powder, yield 58%. Mp 118-120 °C. ^{1}H NMR (300,13 MHz, DMSO-d_6): δ= 2.08 (s, 3H, -NPhC*H*$_3$), 3.37 (s, 3H, -C*H*$_3$, -Tol), 5.61 (s, 1H, -COCH=), 6.81 (d, 2H, ^{3}J = 7.9 Hz, -Tol), 7.05 (d, 2H, ^{3}J = 7.9 Hz, -Tol), 7.13-7.33 (m, 5H, Ph), 7.48 (d, 1H, ^{3}J = 8.8 Hz, Ar), 7.73 (d, 1H, ^{4}J = 2.8 Hz, Ar), 7.96 (dd, 1H, ^{3}J = 8.8 Hz, ^{4}J = 2.8 Hz, Ar). ^{13}C NMR (300,13 MHz, DMSO-d_6): δ = 20.53, 42.40 (2CH_3), 103.37, 123.33, 123.44, 126.43 (4CH), 127.12, 128.05, 129.18, 129.57 (8CH), 130.65 (CH), 131.67, 136.30, 138.33, 142.69, 145.34, 145.67, 164.28, 187.40 (8C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 2920 (m), 1597 (m), 1488 (s), 1390 (m), 1340 (s), 1272 (m), 1093 (m), 1032 (m), 898 (m), 819 (m), 739 (s), 696 (s). MS (GC, 70eV): *m/z* (%) = 406 (M^+, 27), 391 (18), 390 (13), 389 (43), 250 (31), 223 (14), 222 (87), 221 (10), 207 (35), 194 (11), 184 (11), 138 (14), 133 (10), 132 (100), 115 (12), 110 (12), 106 (11), 91 (11), 77 (18). HRMS (EIHR): calcd for $C_{23}H_{19}N_2O_3$ 406.1078, found 406.1084.

General procedure for the synthesis of 12.

Under a constant flow of an inert gas a pressure tube was charged with a magnetic stirrer, 1-(2-chloro-5-nitrophenyl)-3-*p*-tolylprop-2-yn-1-one **6a** (500 mg, 1 equiv.), K_2CO_3 (462 mg, 2 equiv.), extra dry dimethylformamide (9 ml) and diaminobutane (for **12a**) or diaminohexane (for **12b**) (0.51 equiv.). After stirring for 8 h at 120 °C the solvent was evaporated. Residue was recrystallized from toluene.

1,1'-(Butane-1,4-diyl)*bis*(6-nitro-2-*p*-tolylquinolin-4(1*H*)-one) (12a).

Yellow crystals, yield 75%. Mp 370-372 °C. ^{1}H NMR (250,13 MHz DMSO-d_6): δ= 1.55 (br s, 4H, -CH_2-(C*H*$_2$)$_2$- CH_2-), 2.22 (s, 6H, -C*H*$_3$, -Tol), 4.25 (br s, 4H, =NC*H*$_2$(CH_2)$_2$C*H*$_2$N=), 6.98 (s, 2H, 2 COC*H*=), 7.05 (d, 4H, ^{3}J = 8.0 Hz, -Tol, -Tol`), 7.16 (d, 4H, $^{3}J$ = 8.0 Hz, -Tol, -Tol`), 7.98 (d, 2H, ^{3}J = 9.7 Hz, Ar, Ar`), 8.54 (dd, 2H, $^{3}J$ = 9.7 Hz, $^{4}J$ = 2.4 Hz, Ar, Ar`), 9.12 (d, 2H, ^{4}J = 2.4 Hz, Ar, Ar`). $^{13}$C NMR (250.13 MHz, DMSO-$d_6$): δ = 23.00 (2$CH_3$, -Tol, Tol`), 28.31, 53.17 (4CH_2), 113.21, 123.19 (4CH), 124.23 (2C), 124.46 (2CH), 130.20, 131.59 (4CH), 132.69 (2C), 132.84 (2CH), 145.19, 145.49, 148.63, 166.11, 173.26 (10C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 2919 (s), 1631 (s), 1470 (s), 1334 (s), 1171 (m), 1112 (m), 910 (m), 823 (s), 749 (s), 651 (m), 538 (m). HRMS (ESI-TOF): calcd for $C_{36}H_{30}N_4O_6$ 614,2159 found 614,2165.

1,1'-(Hexane-1,6-diyl)*bis*(6-nitro-2-*p*-tolylquinolin-4(1*H*)-one) (12b).

Yellow-green crystals, yield 92%. Mp 333-335 °C. ^{1}H NMR (300,13 MHz DMSO-d_6): δ= 0.84 (br s, 4H, =N-$(CH_2)_2$(CH_2)$_2$(CH_2)$_2$-N=), 1.53 (br s, 4H, =N-CH_2CH_2(CH_2)$_2CH_2CH_2$-N=), 2.23 (s, 6H, Tol-CH_3), 4.34 (t, 4H, ^3J = 7.6 Hz, =N-CH_2(CH_2)$_4CH_2$-N=), 7.03 (s, 2H, 2 COC*H*=), 7.17 (d, 4H, ^3J = 8.3 Hz, -Tol, -Tol`), 7.21 (d, 4H, $^3J$ = 8.3 Hz, -Tol, -Tol`), 8.06 (d, 2H, ^3J = 9.7 Hz, Ar, Ar`), 8.58 (dd, 2H, $^3J$ = 9.7 Hz, $^4J$ = 2.6 Hz, Ar, Ar`), 9.14 (d, 2H, ^4J = 2.6 Hz, Ar, Ar`). ^{13}C NMR (250.13 MHz, DMSO-d_6): δ = 22.75 (2CH_3), 27.59, 31.23, 53.92 (6CH_2), 112.79, 123.17, 124.07 (6CH), 124.44 (2C), 130.13 (4CH), 131.11 (2CH), 132.44 (4CH), 132.77, 144.90, 145.03, 148.26, 165.70, 172.97 (12C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 3057 (w), 2936 (w), 1640 (s), 1469 (s), 1330 (s), 1113 (m), 1057 (m), 910 (m), 832 (m), 745 (m), 653 (w). 528 (m). MS (GC, 70eV): *m/z* (%) = 642 (M^+, 5), 204 (22), 177 (51), 163 (14), 162 (100), 152 (13), 148 (11), 146 (15), 137 (22), 136 (18), 135 (13), 134 (18), 123 (11), 121 (26), 120 (23), 119 (40), 117 (13), 115 (10), 107 (10), 105 (18), 91 (30), 79 (11), 77 (25), 71 (10), 69 (15), 67 (11), 66 (56), 65 (33), 57 (16), 55 (15), 44 (100), 43 (37), 41 (22), 40 (12), 39 (24). HRMS (ESI): calcd for $C_{38}H_{34}N_4O_6$ 642.2472, found 642.2478.

General procedure for the synthesis of 13.

Under a constant flow of an inert gas a pressure tube was charged with magnetic stirrer, 1-(2-chloro-5-nitrophenyl)-3-*p*-tolylprop-2-yn-1-one **6a** (250 mg, 1 equiv.), K_3PO_4 (354 mg, 2 equiv.), extra dry dimethylformamide (4 ml) and 6-amino-1-*n*-propyl-2-*p*-tolyl-4-quinolone **8ai** (for **13a**) or 6-amino-1-isopropyl-2-*p*-tolylquinolin-4(1*H*)-one **8aj** (for **13b**) (0.91 equiv.) under inert gas flow. After stirring for 8 h at 120 °C the solvent was evaporated. Residue was purified by a column chromatography (silica gel, heptane / ethyl acetate, 6:1 to 1:1).

6-Nitro-1'-propyl-2,2'-di*p*-tolyl-4*H*-1,6'-biquinoline-4,4'(1'*H*)-dione (13a).

Brown crystals, yield 11%. Mp 350-352 °C. ^{1}H NMR (300,13 MHz, DMSO-d_6): δ = 0.91-5.00 (m, 13H, Alk), 5.91 (s, 1H, -COCH=), 8.39-8.90 (m, 9 H, Ar), 9.44 (s, 1H, Ar), 9.66 (s, 1H, Ar), 9.97 (s, 1H, Ar), 10.79 (s, 1H, Ar), 14.27 (CF_3COOD). ^{13}C NMR (300,13 MHz, DMSO-d_6): δ = 10.81, 21.56, 21.77 (3CH_3), 24.43, 55.37 (2CH_2), 112.01, 112.08, 123.19, 123.23 (4CH), 123.60 (2CH), 126.30 (C), 128.01 (CH), 129.19, 130.75 (4CH), 130.92 (CH), 131.42 (2CH), 131.53 (C), 131.85 (2CH), 136.48, 138.34, 142.24 (3C), 144.85, 144.86 (4C), 146.18, 148.08, 165.96, 169.66, 173.43 (5C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 1638 (s), 1601 (s), 1469 (s), 1337 (s), 1176 (m), 1063 (m), 822 (s), 745 (m), 582 (m). MS (GC, 70eV): *m/z* (%) = 556 (M^{+1}, 39), 555 (M^+, 100), 554 (M^{-1}, 38), 526 (11). HRMS (EIHR): calcd for $C_{35}H_{29}N_3O_4$ 555.2153, found 555.2136.

1'-Isopropyl-6-nitro-2,2'-di*p*-tolyl-4*H*-1,6'-biquinoline-4,4'(1'*H*)-dione (13b).

Pale brown crystals, yield 19%. Mp 325-327 °C. ^{1}H NMR (250.13 MHz, DMSO-d_6): δ= 1.49 (d, 3H, ^{3}J = 7.1 Hz, CH_3, *i*-Pr), 1.60 (d, 3H, ^{3}J = 7.1 Hz, CH_3, *i*-Pr), 2.23 (s, 3H, CH_3, -Tol), 2.43 (s, 3H, CH_3, -Tol), 4.63 (m, 1H, *i*-Pr), 5.93 (s, 1H, -CO*H*=), 6.32 (s, 1H, -CO*H* =), 7.06 (d, 1H, ^{3}J = 9.5 Hz, Ar), 7.11 (d, 2H, ^{3}J = 8.2 Hz, -Tol), 7.33 (d, 2H, ^{3}J = 7.9 Hz, -Tol), 7.40 (d, 2H, ^{3}J = 8.2 Hz, -Tol), 7.47 (d, 2H, ^{3}J = 7.9 Hz, -Tol), 7.86 (dd, 1H, ^{3}J = 9.2 Hz, ^{4}J = 2.6 Hz, Ar`), 8.13 (d, 1H, $^{3}J$ = 9.2 Hz, Ar`), 8.25 (d, 1H,, ^{4}J = 2.6 Hz, Ar`), 8.38 (dd, 1H, ^{3}J = 9.5 Hz, ^{4}J = 2.8 Hz, Ar), 9.02 (d, 1H, ^{4}J = 2.8 Hz, Ar). ^{13}C NMR (250.13 MHz, DMSO-d_6): δ= 20.28 (CH_3), 20.68 ($2CH_3$), 20.85 (CH_3), 53.92 (CH), 112.39, 112.90, 120.26, 121.23, 121.45 (5CH), 124.99 (C), 126.26, 127.13 (2CH), 127.63 (2CH), 128.16 (C), 128.52, 129.07, 129.45 (6CH), 131.98 (C), 132.47 (CH), 133.52, 133.73, 138.54, 139.19, 139.76, 142.86, 146.08, 155.35, 156.16, 174.60, 175.59 (11C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 2922 (w), 1639 (s), 1602 (s), 1509 (m), 1469 (s), 1376 (m), 1335 (s), 1166 (m), 1063 (m), 823 (s), 746 (m), 533 (w). MS (EI, 70eV): *m/z* (%) = 556 (M^{+1}, 30), 555 (M^{+}, 100), 514 (18), 513 (69), 512 (67), 482 (10), 467 (11), 466 (21), 44 (22). HRMS (EIHR): calcd for $C_{35}H_{29}N_3O_4$ 555.2153, found 555.2145.

General procedure for the synthesis of 14

Preliminarily the 6-amino-4-quinolone 8b (0.2 g, 1 equiv.) was dissolved in 2 ml of acetonitrile. Under the flow of argon a three-necked round-bottom flask equipped with a reflux condenser and a bubble counter was charged with a magnetic stirrer, $CuBr_2$ (1.2 equiv., 145 mg), *t*-$BuNO_2$ (1.5 equiv., 0.1 ml) and 2 ml of acetonitrile. After that it was closed with a septum stopper and stirred for 15 min. After 15 min the solution of 8b was injected to the flask. The stirring was held overnight at room temperature. For product isolation the acetonitrile was evaporated under the reduced pressure and purified by the column chromatography (Eluent Heptane : ethylacetate 4 : 1; $R_f \approx 0.5$). The by-product is 6-Bromo-4-quinolone, yield 17%, $R_f \approx 0.25$.

3,6-dibromo-1-(4-methoxybenzyl)-2-p-tolylquinolin-4(1H)-one (14).

Wight crystals, yield 72 %. Mp 185-186℃. ^{1}H NMR (250.13 MHz, DMSO-d_6): δ= 2.38 (s, 3H, -C*H*$_3$, -Tol), 3.71 (s, 3H, -OC*H*$_3$), 5.28 (s, 2H, -C*H*$_2$-), 6.86 (d, 2H, ^{3}J = 8.8 Hz, Ar`), 7.00 (d, 2H, $^{3}J$ = 8.8 Hz, Ar`), 7.34 (s, 4H, -Tol), 7.56 (d, 1H, ^{3}J = 9.3 Hz, Ar), 7.84 (dd, 1H, ^{3}J = 9.3 Hz, ^{4}J = 2.5 Hz, Ar), 8.41 (d, 1H, ^{4}J = 2.5 Hz, Ar). ^{13}C NMR (250.13 MHz, DMSO-d_6): δ= 20.88 (CH_3), 52.59 (CH_2), 54.97 (CH_3), 108.93 (C), 114.16 (2 CH), 117.14 (C), 121.09 (CH), 125.92 (C), 126.74 (2 CH), 127.49 (C), 127.69 (2 CH), 128.05 (CH), 129.48 (2 CH), 132.53 (C), 135.11

(CH), 138.50, 139.38, 153.82, 158.41, 169.96 (5 C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 2919 (w), 1610 (s), (1588 (s), 1504 (s), 1454 (s), 1247 (s), 1175 (s), 1098 (m), 1029 (m), 888 (m), 804 (s), 748 (m), 657 (m), 536 (m). MS (GC, 70eV): *m/z* (%) = 513 (M^+, 5), 122 (26), 121 (100), 78 (10).HRMS (ESI): calcd for $C_{24}H_{19}{}^{80}Br_2NO_2$ 510.9777, found 510.9759; calcd for $C_{24}H_{19}{}^{80}Br^{81}Br\ NO_2$ 512.9757, found 512.9749; calcd for $C_{24}H_{19}{}^{81}Br_2NO_2$ 514.9736, found 514.9737.

General procedure for the synthesis of 15

A two-necked round bottom flask, where one neck was equipped with an airproof water condenser, was charged with a magnetic stirrer, **14** (1 equiv., 200 mg), appropriate boronic acid (2.4 equiv.), tetrakis(triphenylphosphine)palladium(0) (0.2 equiv., 96 mg) and closed with a rubber septa. This mixture was threefold vacuumized and filled with argon and afterwards 11 ml of toluene were injected to the flask through the rubber septa. K_2CO_3 (20 equiv., 1154 mg) dissolved in a mixture of H_2O (2 ml) and MeOH (3 ml) was injected to the flask. After that the reaction was stirred under an inert atmosphere at 90°C for 4 hours. The product was purified by column chromatography (silica gel, heptanes-ethyl acetate eluent).

3,6-bis(4-ethylphenyl)-1-(4-methoxybenzyl)-2-p-tolylquinolin-4(1H)-one (15).

Pale yellow crystals, yield 10 %. Mp 232-234 ℃. ^{1}H NMR (300.13 MHz, DMSO-d_6): δ= 1.15 (t, 3H, ^3J = 7.5 Hz, -CH_2-CH_3), 1.24 (t, 3H, ^3J = 7.5 Hz, -CH_2-CH_3), 2.22 (s, 3H, -Tol), 2.50 (1/2 q, 2H + DMSO-d_6, ^3J = 7.5 Hz, -CH_2-CH_3), 2.68 (q, 2H, ^3J = 7.5 Hz, -CH_2-CH_3), 5.24 4(s, 2H, -CH_2-, Ar`), 6.89 (d, 2H, ^3J = 8.7 Hz, Ar), 6.95-7.10 (m, 8H, Ar), 7.19 (d, 2H, ^3J = 7.8 Hz, Ar), 7.36 (d, 2H, ^3J = 7.8 Hz, Ar), 7.64 (d, 1H, ^3J = 9.1 Hz, Ar), 7.68 (d, 2H, ^3J = 8.1 Hz, Ar), 7.97 (dd, 1H, ^3J = 9.1 Hz, ^4J = 2.3 Hz, Ar), 8.54 (d, 1H, ^4J = 2.3 Hz, Ar). ^{13}C NMR (300.13 MHz, DMSO-d_6): δ= 15.34 , 15.52, 20.72 (3 CH_3), 27.74, 27.78 (2 CH_2), 51.06 (CH_2), 54.97 (CH_3), 114.15 (2 CH), 118.96, 122.82 (2 CH), 123.60 (C), 126.48 (4 CH), 126.82, 128.52 (4 CH), 128.57 (C), 128.59, 128.99 (4 CH), 130.40 (CH), 131.29 (2 CH), 131.59, 133, 69, 134.99, 136.29, 137.93, 139.32, 140.88, 143.27, 152, 30 (8 C), 158.30 (2 C), 175.09 (C). IR (ATR, cm^{-1}): $\tilde{\nu}$= 2924 (w), 1591 (s), 1505 s), 1479 (m), 1454 (m), 1327 (w), 1288 (m), 1244 (s), 1174 (m), 1113 (m), 1032 (m), 907 (m), 811 (m), 747 (m), 657 (m), 534 (m). MS (GC, 70eV): *m/z* (%) = 564 (M^{+1}, 12), 563 (M^+, 32), 540 (25), 539 (72), 538 (25), 537 (70), 459 (11), 458 (11), 443 (29), 442 (64), 441 (11), 419 (19), 417 (19), 339 (11), 338 (11), 337 (11), 322 (20), 122 (77), 121 (100), 91 (12), 77 (13). HRMS (ESI-TOF): calcd for $C_{40}H_{37}NO_2$ 563.2818, found 563.2824.

General procedure for the synthesis of 16

Compound **16** was synthesized analogously to **15**.

3,6-bis(4-ethylphenyl)-4H-chromen-4-one (16).

White crystals, yield 48 %. Mp 135-137 ℃. ^{1}H NMR (300.13 MHz, DMSO-d_6): δ= 1.25 (dt, 6H, ^{3}J = 7.6 Hz, 2 C*H*$_3$-CH$_2$-C$_4$H$_4$-), 2.69 (dq, 4H, ^{3}J = 7.6 Hz, 2 CH$_3$-C*H*$_2$-C$_4$H$_4$-), 7.31 (d, 2H, ^{3}J = 8.2 Hz, Ar`), 7.37 (d, 2H, ^{3}J = 8.2 Hz, Ar``), 7.56 (d, 2H, $^{3}J$ = 8.2 Hz, Ar`), 7.69 (d, 2H, $^{3}J$ = 8.2 Hz, Ar``), 7.77 (d, 1H, ^{3}J = 8.8 Hz, Ar), 8.12 (dd, 1H, ^{3}J = 8.8 Hz, ^{4}J = 2.3 Hz, Ar), 8.33 (d, 1H, ^{4}J = 2.3 Hz, Ar), 8.55 (s, 1H, -C*H*=). ^{13}C NMR (300.13 MHz, DMSO-d_6): δ= 15.44, 15.58 (2 CH$_3$), 27.75, 27.92 (2 CH$_2$), 119.03, 122.29 (2 CH), 123.79, 123.98 (2 C), 126.73, 127.55, 128.51, 128.81 (8 CH), 129.12 (C), 132.36 (CH), 135.89, 137.31, 143.53, 143.60 (4 C), 154.25 (CH), 154.88, 175.13 (2 C). IR (ATR, cm^{-1}): $\tilde{\nu}$ = 2961 (w), 1640 (s), 1610 (s), 1475 (s), 1329 (m), 1267 (s), 1229 (m), 1186 (m), 1115 (m), 1048 (m), 899 (m), 816 (s), 666 (m), 551 (m). MS (GC, 70eV): *m/z* (%) = 354 (M^{+}, 100), 339 (45), 162 (11), 115 (18). HRMS (ESI): calcd for $C_{25}H_{22}O_2$ 354.1614, found 354.1620.

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32. Crystallographic data (excluding structure factors) for compounds **7ab**, **7ac**, **7bd**, **15** and **16** reported in this paper have been deposited with the Cambridge Crystallographic Data Centre as supplementary publication no. xxx and can be obtained free of charge on application to CCDC, 12 Union Road, Cambridge CB2 1EZ, UK; fax: þ 44(1223)336033; e-mail: deposit@ccdc.cam.ac.uk, or via www.ccdc.cam.ac.uk/data_request/cif.

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