A Novel *o*-Iminophenyl Anion Route to Heterocycles and *Ortho*-Substituted Anilines

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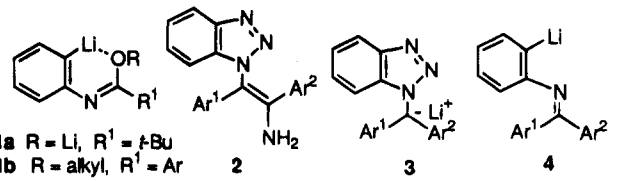
Ring opening of lithio derivatives of *N*-(α-alkoxyalkyl)benzotriazoles **9** and **22** and subsequent extrusion of nitrogen at −78 °C gave novel *o*-iminophenyl anions which enable synthetically useful preparations of *ortho*-substituted anilines (**19** and **25**) and of benzoheterocycles (**14**, **20**, **21**, **24**, and **26**).

Ortho-substituted anilines are important starting materials for heterocyclic compounds and pharmaceuticals.[1a–c] Although the electrophilic substitution of N-acylated anilines is feasible, the formation of isomers can be synthetically unattractive. Directed *ortho*-metalations have evolved as an important alternative and regiospecific strategy: variations include reactions of anilinodichloroborane with electrophiles[1a] and heteroatom-facilitated dilithiation of aromatic amines followed by electrophilic substitution.[2a,b] In recent contributions from our laboratory, carbon dioxide has been successfully used as an easily introducable and removable protecting group for the conversion of *N*-alkylanilines[3] and of *N*-methyl-1- and *N*-methyl-2-naphthylamines[4] into *ortho*-substituted *N*-alkylanilines and *N*-alkyl-2-naphthylamines, respectively. For *ortho*-metalation of *N*-unsubstituted anilines, the NH_2 group of the aniline has been converted into an amide which then undergoes dilithiation: *p*-chloro- and *o*-methoxy-substituted *N*-pivalanilines smoothly undergo *ortho*-lithiation with butyllithium in THF at 0 °C, but the dilithiation of unsubstituted *N*-pivalaniline requires forcing conditions (at 20 °C) and either a 50% excess of butyllithium to make up for its consumption by the solvent[2a] or the use of *t*-BuLi.[2b] Moreover, the competing *N*-alkylation of **1a** leading to formation of byproducts of dialkylation[2a] is another drawback of this method. An alternative strategy for the *O*-alkylation of anilines would be to use *O*-protected amides **1b**; however, we located no literature report of *O*-protected anions **1b**.

Benzotriazole is a highly stable compound. Most reported ring openings require forcing conditions such as pyrolysis or photolysis, and extrusion of nitrogen often gives complex rearranged products *via* ionic or radical fragmentation.[5a–c] We found that Grignard reactions of α-benzotriazolylalkyl ethers at 110 °C can result in the loss of a single nitrogen atom after the ring cleavage to give *o*-aminoaniline derivatives.[6] Recently, ring opening of benzotriazole was achieved under milder conditions using reactants bearing electron-donor groups at the carbon adjacent to the benzotriazole ring: thus, the ring opening, rearrangement, and loss of nitrogen from 2-(benzotriazol-1-yl)enamines **2** was achieved in refluxing toluene giving quinazolines,[7] and furthermore, ring fragmentation of the diarylbenzotriazolylmethane anion **3** was accomplished at room temperature.[8] Both of these ring-opening reactions involve cleavage of the bond between the N-1 and the N-2 atoms followed by extrusion of nitrogen to give an *o*-iminophenyl anion such as **4**, and in both cases the resulting *o*-iminophenyl anion underwent, at the temperatures required for ring opening, immediate intramolecular reactions, affording useful preparations of heterocycles. The corresponding *o*-iminophenyl anion intermediates thus formed would be difficult to trap with external electrophiles because these intermediates readily undergo intramolecular reactions, dimerizations, polymerization, *etc.*

We have now identified lithio derivatives of *N*-(α-alkoxyalkyl)benzotriazoles (**9a,b** and **22a–c**) which undergo ring opening at low temperatures and have been able to trap the generated *ortho*-iminophenyl anion intermediates with a variety of electrophiles. In effect, we have found that *o*-iminophenyl anions of type **1b** can conveniently be prepared from the ring opening of readily available *N*-(α-alkoxyalkyl)benzotriazoles.



1a R = Li, R^1 = *t*-Bu
1b R = alkyl, R^1 = Ar

2 **3** **4**

Results and Discussion

N-(α-Alkoxyalkyl)benzotriazoles **9a,b**[9] and **22a**[10] were previously prepared from this laboratory. Novel com-

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Scheme 1

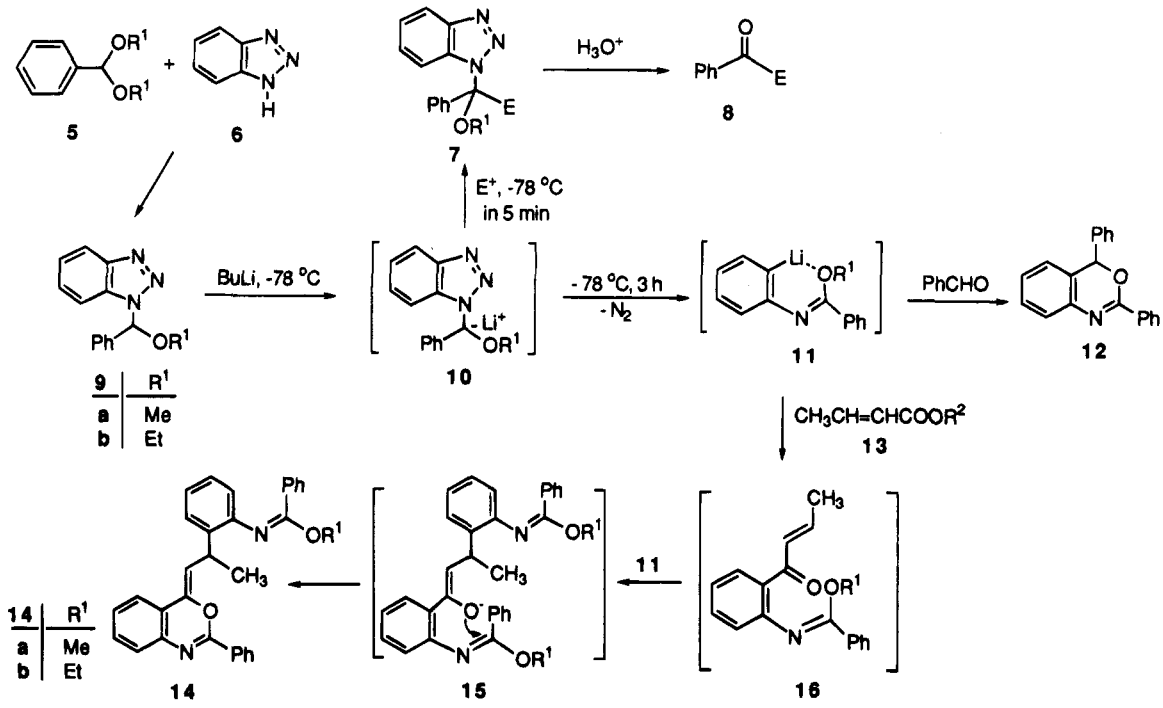

Table 1. Preparation of Compounds 12, 14, 19–22, and 24–26

compd	$R^1(Ar^1)$	Ar	yield (%)	molec formula	CHN analysis, found (required) C	H	N
12			57	$C_{20}H_{15}NO$	84.36 (84.19)	5.35 (5.30)	4.85 (4.91)
14a	Me		44	$C_{31}H_{26}N_2O_2$	81.23 (81.20)	5.71 (5.71)	6.06 (6.11)
14b	Et		46	$C_{32}H_{28}N_2O_2$	80.99 (81.33)	5.95 (5.97)	5.86 (5.93)
19a	Ph	Ph	57	$C_{23}H_{21}NO_2$	80.49 (80.44)	6.23 (6.16)	4.01 (4.08)
19b	Me	Ph	17	$C_{18}H_{19}NO_2$	76.51 (76.84)	6.84 (6.81)	5.12 (4.98)
20a[a]	*p*-tolyl	Ph	55	$C_{21}H_{17}NO$	84.02 (84.25)	5.71 (5.72)	4.55 (4.68)
20b[a]	Ph	Ph	70	$C_{26}H_{19}NO$	86.50 (86.40)	5.21 (5.30)	3.75 (3.88)
20c[a]	Ph	Ph	60	$C_{21}H_{17}NO$	83.93 (84.24)	5.83 (5.73)	4.89 (4.68)
20d	b	Ph	53	$C_{19}H_{19}NO$	82.22 (82.28)	6.92 (6.90)	4.96 (5.05)
21a[a]	Ph	Ph	83	$C_{26}H_{20}N_2$	86.39 (86.64)	5.69 (5.59)	7.71 (7.77)
21b[a]	*p*-$MeOC_6H_4$	Ph	80	$C_{28}H_{24}N_2O$	82.91 (83.14)	6.27 (5.98)	6.70 (6.93)
21c[a]	*p*-MeC_6H_4	1-naphthyl	79	$C_{32}H_{26}N_2$	87.93 (87.64)	5.98 (5.98)	6.34 (6.39)
22b		*p*-tolyl	80	$C_{17}H_{19}N_3O$	72.64 (72.51)	6.82 (6.81)	14.97 (14.93)
22c		1-naphthyl	56	$C_{20}H_{19}N_3O$	75.45 (75.69)	6.02 (6.03)	13.24 (13.24)
24a	Ph	Ph	81	$C_{20}H_{14}N_2$	84.91 (85.06)	4.99 (5.00)	9.89 (9.92)
24b	*p*-tolyl	Ph	47	$C_{21}H_{16}N_2$	85.48 (85.11)	5.51 (5.44)	9.41 (9.45)
25a	Me	Ph	77	$C_{17}H_{19}NO$	80.98 (80.60)	7.69 (7.56)	5.40 (5.53)
25b	*n*-Bu	Ph	88	$C_{20}H_{25}NO$	81.68 (81.31)	8.81 (8.53)	4.34 (4.74)
26a		*p*-tolyl	67	$C_{21}H_{16}N_2S$	77.01 (76.80)	4.94 (4.91)	8.49 (8.53)
26b		1-naphthyl	74	$C_{24}H_{16}N_2S$	79.30 (79.09)	4.58 (4.42)	7.76 (7.69)

[a] $R^2(Ar^2)$ = H (**20a**); Ph (**20b**), Me (**20c**); Ph (**21a**); *p*-MeC_6H_4 (**21b**), *p*-MeC_6H_4 (**21c**). [b] R^1, R^2 = $-(CH_2)_5-$ (**20d**).

pounds **22b,c** were prepared according to a literature method[10] and were characterized by NMR spectroscopy and elemental analyses.

Previous work from this laboratory[11] demonstrated that treatment of compound **9a** or **9b** with *n*-BuLi at −78 °C for 1 or 2 min gave green solutions of **10** which could be trapped by immediate treatment with electrophiles such as aldehydes and halides to give alkylated adducts **7** in good yield; this provides a versatile synthesis of aryl and heteroaryl ketones of type **8**. We now find that if the lithio derivative of **9** is allowed to stand at −78 °C for 3 h, or to warm to −30 °C (instead of immediate trapping with electrophiles), the green solution changed to brown, and subsequent treatments either with ethyl crotonate or with methyl crotonate each gave similar compounds **14a** and **14b**, respectively, in 44–46% yield, instead of the expected product of type **7** (Scheme 1). The structures of products **14a,b** were supported by NMR spectroscopy and CHN analyses (Table 1), and **14a** was confirmed by single crystal X-ray crystallography (Figure 1). The benzoxazine system is planar and has a bonding geometry similar to that found in previously reported structures of 3,1-benzoxazin-4-ones.[12a–e] The attached phenyl ring is nearly coplanar, the angle between the respective meanplanes being 9.7°. The geometry of the exocyclic double bond is *Z*, while the geometry of the

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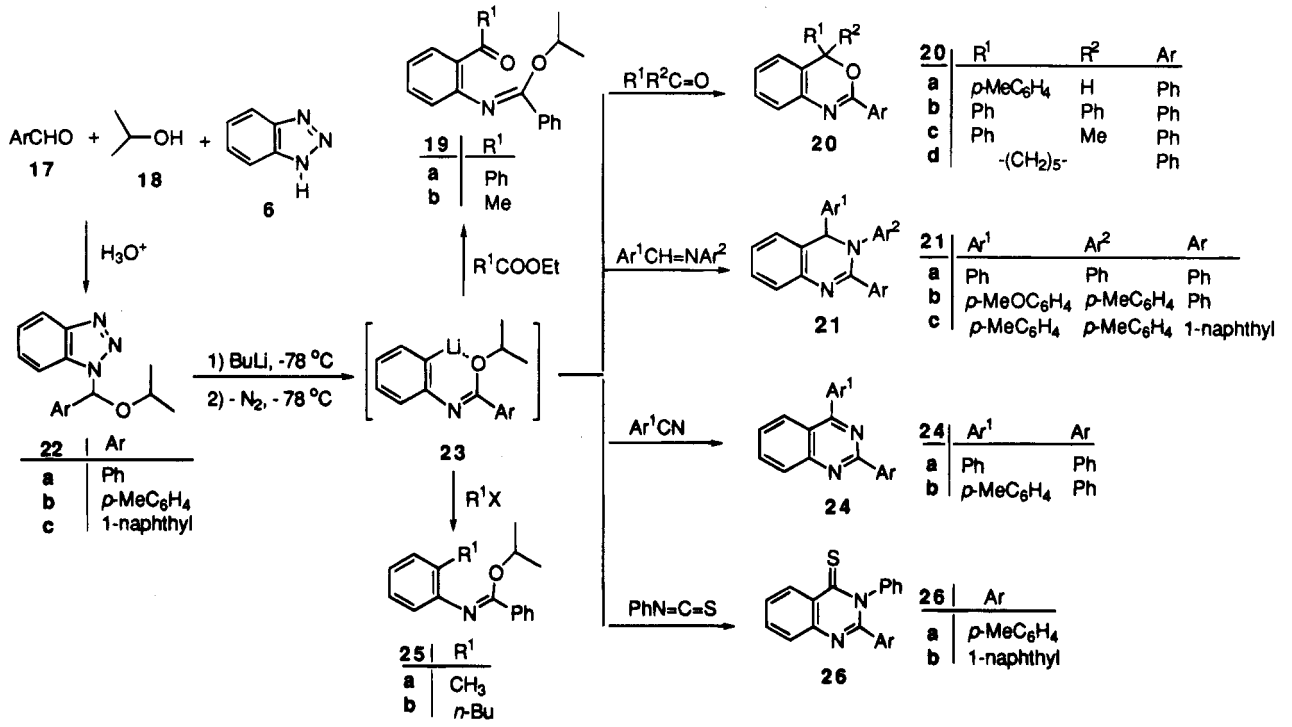
Scheme 2



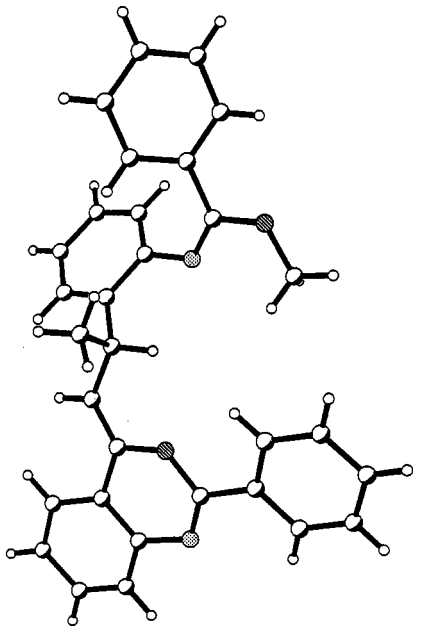


Figure 1. Perspective view of the X-ray structure of 3,1-benzoxazine **14a.**

imidate system is *E*. The *C*-phenyl ring is inclined to the imidate mean plane at an angle of 46.4°, while the *N*-aryl ring mean plane is inclined at an angle of 128°. There are no unusual bond lengths or angles or short intermolecular atom contacts.

The mechanism for the formation of **14a,b** probably involves intermediates **11** which were formed from **10** by ring opening of the benzotriazole moiety followed by loss of N_2. 1,2-Additions of anion **11** to methyl or ethyl crotonate forms an α,β-unsaturated ketone **16**. The crowded environment of the carbonyl group of **16** directs the second molecule of **11** to undergo 1,4-addition to give enolate **15**, which undergoes ring closure *via* intramolecular displacement of the ethoxide or methoxide group by the enolate oxygen to form **14**. Intramolecular substitution by C–C bond formation involving the enolate carbon of **15** was not observed, presumably because of steric hindrance. The formation of anion **11** was further supported by reaction with benzaldehyde, which gave product **12** (35%) by nucleophilic addition of the anion **11** to benzaldehyde followed by intramolecular displacement of the ethoxide or methoxide by the newly generated anionic oxygen. Compared with the ring opening of the diarylbenzotriazolylmethane anion **3**,[8] which requires a temperature of 20 °C, the present benzotriazole ring opening of **10** at −78 °C perhaps reflects electronic destabilization of the carbanion by the electron pair of the alkoxy group.

Encouraged by these results, we turned our attention to the isopropyl analogs **22a–c** of the methyl and ethyl derivatives **9a,b**. As expected, **22a–c** are lithiated by butyllithium and subsequent ring opening at −78 °C generates the *o*-iminophenyl lithiums **23a–c** (Scheme 2). Ring opening of the lithio derivatives of the sterically more hindered compounds **22a–c** (each with an isopropyl group) was even faster than that of the carbanions **10a,b** (with an ethyl or methyl group on the oxygen atom). When compound **22a** was treated with butyllithium, the deep green solution that formed upon addition of butyllithium disappeared with the evolution of N_2 in less than 1 min to give a brown color. Under the same conditions as previously used for the preparation of compounds **7** (in which lithiation of **9** was immediately followed by reaction with an aldehyde or halide),[11] treatment of the lithio derivative of **22a** with benzaldehyde gave no detectable product of type **7**. By contrast, the isolated yield of **12** was increased from the 35% obtained using ethoxy compound **9b** to 57% when **22a** was used. Similarly, treatment with ketones of the anion **23a** derived from **22a** resulted in the formation of **20b–d** in 53–70% yield. Compounds **20** are all stable, and the possible intermediates of the addition of the anion **23a** to the aldehydes and ketones prior to ring closure were not

detected, demonstrating that the isopropoxide in **23a** is a good leaving group. We believe that the more sterically hindered isopropyl in **22a–c** (as compared with ethyl or methyl in **9a,b**) plays three roles: (i) the isopropoxide renders the lithio derivatives of **22a–c** more crowded, thus completely preventing its direct alkylation, (ii) the steric relief gained by formation of anions **23a–c** accelerates the ring openings of the litho derivatives of **22a–c**, and (iii) the bulky isopropyl group renders the isopropoxide a better leaving group, thus facilitating ring closure of the initial addition adducts of **23a–c** with the appropriate electrophiles.

From a synthetic point of view, the ring-opening reaction of compounds **22** provides a new method for the preparation of benzoxazines of type **20** with the breaking of two bonds and the formation of two new bonds in a one-pot procedure. Benzoxazines **20** were previously prepared by reactions (i) of *N*-(*o*-acylphenyl)imidates with organometallics,[13] (ii) of allenic nitriles with 2-aminobenzyl alcohol,[14] and (iii) from 2-(aroylamino)benzophenones and PBr_3.[15] The present one-pot procedure can potentially generate a wide variety of benzoxazines **20** derived from either aldehydes or ketones.

Anion **23a** was shown to react with halides and esters to give compounds **19a,b** and **25a,b**, respectively, in which the isopropoxy group is retained. Compound **19b**, derived from the enolizable acetate, was obtained in a low yield probably because the anion **23a** behaves as a base to convert the ester to an enolate. Previous preparations of *N*-arylimidates have included (i) alkylation of amides at the oxygen atom,[16] (ii) reaction of arylamines with alkyl orthonates,[16] and (iii) reaction of chromium carbenes with sulfinimines.[17] Our one-pot preparation of imidates **19a,b** and **25a,b** provides isopropoxy-substituted imidate functionality and also forms a new C–C bond *ortho* to the nitrogen atom in the phenyl ring.

Additions of the anions **23a–c** to an electrophile followed by ring closure were shown to be a general route for the preparation of benzoheterocycles, many of which (including **20**) are of pharmacological interest.[14,18a,b] Thus, treatment of the anions **23a,c** with diarylimines gave 3,4-dihydroquinazolines **21a–c** in 79–83% yield. 2,3,4-Triaryl-3,4-dihydroquinazolines similar to **21** were previously prepared by condensing 2 equiv of aroyl chlorides with primary arylamines at 200–220 °C,[19] but these products necessarily have two identical substituents at the 2- and 4-positions. Our one-pot approach to **21** can introduce different aryl substituents at the 2-, 3-, and 4-positions and proceeds under milder conditions.

When the anion **23a** was reacted with nitriles, quinazolines **24a,b** were obtained in 47–81% yield. We have previously reported preparations of diarylbenzoquinazolines of type **24** by the ring-opening rearrangement of 2-(benzotriazol-1-yl)enamines in refluxing toluene.[7] Anions **23** provide an alternative approach to compounds of type **24** under milder conditions (−78 to 20 °C).

Similarly, when the anions **23a,b** were treated with isothiocyanates, compounds **26a,b** were isolated in 67–74% yield. Preparation of compounds of type **26** were reported in the literature by reaction of 3,1-benzothiazine-4-thione with primary amines.[20a,b] The present method for the preparation of compounds **26** commences with readily available starting materials. All compounds **20**, **21**, **24**, **25**, **19**, and **26** showed the expected NMR spectra, and their structures were confirmed by CHN analyses.

In summary, *N*-(α-isopropoxyalkyl)benzotriazoles **22** form novel phenyl anions **23** which react with a variety of electrophiles and can advantageously be used in place of the previously reported anion **1a**:[2a] (i) anions **23** are more conveniently prepared than **1a** under normal lithiation conditions (1 equiv of butyllithium at −78 °C), (ii) use of **23** avoids formation of the byproducts of dialkylation which can arise with **1a**, and (iii) anions **23** can be visualized as the isopropyl-protected **1a**; thus, they are well suited to the synthesis of heterocycles (isopropoxide is a convenient leaving group). We have described the synthesis of a number of heterocycles and *ortho*-substituted anilines *via* **23**.

Experimental Section

^1H and ^{13}C NMR spectra were recorded in $CDCl_3$. THF was freshly distilled from sodium–benzophenone ketyl immediately before use. Lithiations were carried out in an argon atmosphere created by evacuating the flask using a vacuum pump followed by filling it with argon several times. Column chromatography was carried out on MCB silica gel (230–400 mesh). Most analytically pure compounds **19–26** were obtained by column chromatography using ethyl acetate/hexane, 1:5 as solvent, without further recrystallization. As compounds **22a–c** were not very stable upon column chromatography, they were usually used directly in subsequent reactions. The samples of **22b,c** for CHN analyses were obtained by recrystallization (vide infra). Compound **22a** was obtained according to the literature procedure.[10]

Preparation of 2,4-Diphenyl-4*H*-3,1-benzoxazine (12). Benzotriazole derivative **9b** (2.5 g, 10.0 mmol) was stirred with butyllithium (2 M, 5.5 mL, 11 mmol) in THF (100 mL) at −78 °C for 3 h. Benzaldehyde (1.1 g, 10 mmol) was added at −78 °C, and the mixture was stirred at −78 °C for 3 h and at 20 °C for 12 h. The reaction was quenched with H_2O (30 mL) and extracted with Et_2O (3 × 30 mL). The extract was washed with NaOH (2 N, 25 mL) and dried ($MgSO_4$) and the solvent removed to give an oil which was purified by column chromatography (ethyl acetate/hexane, 1:5) to give a yellow solid (1.0 g, 35%). Compound **12** was also prepared from **22a** and benzaldehyde in 57% yield: mp 114–115 °C; ^1H NMR δ 6.38 (s, 1 H), 6.79 (d, J = 7.7 Hz, 1 H), 7.07–7.13 (m, 1 H), 7.28–7.44 (m, 10 H), 8.13 (d, J = 6.6, 2 H); ^{13}C NMR δ 78.3, 124.9, 125.0, 125.1, 126.4, 127.6, 128.0, 128.1, 128.6, 128.7, 129.0, 131.3, 132.5, 139.3, 139.7, 156.7.

Preparation of 4*H*-3,1-Benzoxazines 14. Representative Procedure for 4-{2-[α-[(Methoxybenzylidene)amino]-phenyl]propylidene}-4*H*-3,1-benzoxazine (14a). Benzotriazole derivative **9a** (3.6 g, 15 mmol) was stirred with butyllithium (2 M, 8 mL, 16 mmol) in THF (75 mL) at −78 °C for 3 h. Ethyl crotonate (1.7 g, 15 mmol) was added at −78 °C, and the mixture was stirred at −78 °C for 3 h and at 20 °C for 12 h. The reaction was quenched with H_2O (30 mL) and extracted with diethyl ether (3 × 30 mL). The extract was washed with NaOH (2 N, 25 mL) and dried ($MgSO_4$) and the solvent removed to give an oil which was purified by column chromatography (ethyl acetate/hexane, 1:5) to give a

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yellow solid (3.0 g, 44%): mp 130–131 °C; ^{1}H NMR δ 1.32 (d, J = 7.1 Hz, 3 H), 3.76 (s, 3 H), 4.36–4.51 (m, 1 H), 5.30 (d, J = 9.2 Hz, 1 H), 6.36 (d, J = 7.1 Hz, 1 H), 6.82–7.30 (m, 15 H), 8.04 (dd, J = 7.0, 1.3 Hz, 2 H); ^{13}C NMR δ 21.2, 30.4, 53.7, 107.4, 121.2, 121.4, 121.5, 123.1, 126.2, 126.5, 127.1, 127.6, 127.7, 127.8, 128.1, 129.0, 129.6, 129.8, 130.8, 131.4, 131.5, 136.5, 138.5, 143.3, 145.9, 154.8, 157.3.

4-{2-[α-(Ethoxybenzylideneamino)phenyl]propylidene}-4*H*-3,1-benzoxazine (14b) was prepared from **9b** as a yellow solid (46%): mp 94–95 °C; ^{1}H NMR δ 1.22 (t, J = 7.1 Hz, 3 H), 1.46 (d, J = 7.1 Hz, 3 H), 4.36 (q, J = 7.1 Hz, 2 H), 4.48–4.60 (m, 1 H), 5.40 (d, J = 9.2 Hz, 1 H), 6.47 (d, J = 7.0 Hz, 1 H), 6.95–7.04 (m, 2 H), 7.05–7.14 (m, 3 H), 7.15–7.21 (m, 1 H), 7.23–7.27 (m, 2 H), 7.28–7.35 (m, 3 H), 7.36–7.51 (m, 4 H), 8.14 (d, J = 7.0 Hz, 2 H); ^{13}C NMR δ 14.2, 21.2, 30.5, 62.3, 107.5, 121.3, 121.5, 121.6, 123.0, 126.3, 126.4, 126.5, 127.2, 127.7, 127.8, 128.2, 129.0, 129.6, 129.7, 131.2, 131.4, 131.6, 136.6, 138.6, 143.3, 146.2, 154.9, 157.1.

Preparation of Benzotriazole Derivatives 22. Representative Procedure for *N*-(α-Isopropoxyl-4-methylbenzyl)benzotriazole (22b). Benzotriazole (14.3 g, 120 mmol), *p*-tolualdehyde (12.0 g, 96 mmol), isopropyl alcohol (9.0 g, 150 mmol) and *p*-toluenesufonic acid (0.15 g) were heated under reflux for 5 h in benzene (150 mL). The reaction mixture was washed with NaOH (1 N, 50 mL) and dried ($MgSO_4$) and the solvent removed to give a yellow oil which was recrystallized (from hexane–Et_2O) to give white needles (80%): mp 57–58 °C; ^{1}H NMR δ 1.00 (d, J = 6.2 Hz, 3 H), 1.36 (d, J = 6.1 Hz, 3 H), 2.32 (s, 3 H), 3.72–3.84 (m, 1 H), 7.14 (d, J = 8.0 Hz, 2 H), 7.28–7.32 (m, 5 H), 7.36–7.37 (m, 1 H), 8.03–8.07 (m, 1 H); ^{13}C NMR δ 21.0, 22.6, 70.6, 87.5, 111.8, 119.7, 124.0, 125.8, 127.1, 129.1, 131.0, 133.9, 138.6, 146.9.

***N*-[α-Isopropoxy-α-(naphth-2-yl)methyl]benzotriazole (22c)** was prepared in THF from 1-naphthaldehyde and recrystallized from hexane/Et_2O to give colorless needles (56%): mp 160–161 °C; ^{1}H NMR δ 1.05 (d, J = 6.0 Hz, 3 H), 1.41 (d, J = 6.0 Hz, 3 H), 3.86–3.93 (m, 1 H), 7.19–7.25 (m, 2 H), 7.30–7.33 (m, 1 H), 7.38–7.43 (m, 2 H), 7.60 (t, J = 7.5 Hz, 1 H), 7.79–7.82 (m, 1 H), 7.87–7.93 (m, 1 H), 7.95 (s, 1 H), 7.97–8.00 (m, 1 H), 8.08–8.14 (m, 1 H), 8.27 (d, J = 7.2 Hz, 1 H); ^{13}C NMR δ 21.2, 22.7, 70.8, 85.1, 111.6, 119.8, 122.6, 123.9, 124.6, 124.7, 125.8, 126.9, 127.2, 128.8, 130.1, 130.2, 131.3, 131.4, 133.7, 146.9.

General Procedure for Imidates 19 and 25, 4*H*-3,1-Benzoxazines 20, 3,4-Dihydroquinazolines 21 and 26, and Quinazolines 24. Benzotriazole derivative **22** (10 mmol) was stirred with butyllithium (2 M, 5.5 mL, 11 mmol) in THF (100 mL) at −78 °C for 15 min. An appropriate electrophile (10 mmol), i.e., an ester for **19**, an aldehyde or a ketone for **20**, an imine for **21**, a nitrile for **24**, a halide for **25**, and phenyl isothiocyanate for **26**, in THF (10 mL) was added at −78 °C, and the mixture was stirred at −78 °C for 3 h and at 20 °C for 12 h. The reaction was quenched with H_2O (30 mL) and extracted with Et_2O (3 × 30 mL). The extract was washed with NaOH (2 N, 25 mL) and dried ($MgSO_4$) and the solvent removed to give an oil which was purified by column chromatography (ethyl acetate/hexane, 1:5) to give an oil or solid as the product.

Isopropyl *N*-(2-benzoylphenyl)benzaimidate (19a) was prepared from **22a** and ethyl benzoate as a white solid (57%): mp 103–104 °C; ^{1}H NMR δ 1.15 (d, J = 6.2 Hz, 6 H), 4.78–4.86 (m, 1 H), 6.72 (d, J = 7.8 Hz, 1 H), 7.02 (t, J = 7.1 Hz, 1 H), 7.13–7.40 (m, 9 H), 7.48–7.53 (m, 1 H), 7.69 (d, J = 6.9 Hz, 2 H); ^{13}C NMR δ 21.6, 69.0, 122.0, 122.5, 127.9, 128.0, 129.1, 129.6, 129.8, 131.2, 131.4, 131.6, 132.4, 137.8, 147.4, 158.5, 197.4.

Isopropyl *N*-(2-acetylphenyl)benzaimidate (19b) was prepared from **22a** and ethyl acetate as a yellow oil (17%): ^{1}H NMR δ 1.45 (d, J = 6.2 Hz, 6 H), 2.53 (s, 3 H), 5.36–5.45 (m, 1 H), 6.56 (d, J = 8.3 Hz, 1 H), 6.99 (t, J = 7.7 Hz, 1 H), 7.18–7.22 (m, 3 H), 7.26–7.29 (m, 3 H), 7.64 (d, J = 7.8 Hz, 1 H); ^{13}C NMR δ 22.0, 30.1, 69.1, 122.2, 122.9, 127.9, 129.0, 129.2, 129.9, 131.0, 131.6, 132.3, 148.0, 157.9, 200.5.

2-Phenyl-4-*p*-tolyl-4*H*-3,1-benzoxazine (20a) was prepared from **22a** and *p*-tolualdehyde as a white solid (55%): mp 80–81 °C; ^{1}H NMR δ 2.25 (s, 3 H), 6.31 (s, 1 H), 6.76 (d, J = 7.7 Hz, 1 H), 7.03–7.11 (m, 3 H), 7.21–7.25 (m, 2 H), 7.26–7.41 (m, 5 H), 8.10–8.14 (m, 2 H); ^{13}C NMR δ 21.0, 78.1, 124.8, 125.0, 125.1, 126.3, 127.5, 127.9, 128.0, 128.9, 129.2, 131.2, 132.5, 136.8, 138.5, 139.3, 156.6.

2,4,4-Triphenyl-4*H*-3,1-benzoxazine (20b) was prepared from **22a** and benzophenone as a white solid (70%): mp 222–223 °C; ^{1}H NMR δ 6.74 (d, J = 7.4 Hz, 1 H), 7.11–7.17 (m, 1 H), 7.21–7.31 (m, 10 H), 7.35–7.49 (m, 5 H), 8.20–8.22 (m, 2 H); ^{13}C NMR δ 86.1, 124.9, 126.0, 126.8, 127.9, 128.0, 128.1, 128.2, 128.3, 128.6, 129.2, 131.4, 132.6, 139.9, 142.8, 156.8.

2,4-Diphenyl-4-methyl-4*H*-3,1-benzoxazine (20c) was prepared from **22a** and acetophenone as a yellow oil (60%): ^{1}H NMR δ 2.08 (s, 3 H), 7.09 (d, J = 7.8 Hz, 1 H), 7.16–7.31 (m, 4 H), 7.32–7.49 (m, 7 H), 8.21 (d, J = 7.8 Hz, 2 H); ^{13}C NMR δ 27.8, 81.2, 124.3, 125.1, 125.8, 126.4, 127.8, 127.9, 128.2, 128.8, 129.8, 131.3, 132.7, 139.2, 144.0, 156.7.

2-Phenyl-4-(1,5-pentylidene)-4*H*-3,1-benzoxazine (20d) was prepared from **22a** and cyclohexanone as a white solid (53%): mp 87–88 °C; ^{1}H NMR δ 1.25–1.45 (m, 1 H), 1.66–1.79 (m, 4 H), 1.84–2.01 (m, 3 H), 2.19–2.30 (m, 2 H), 7.11–7.21 (m, 2 H), 7.22–7.33 (m, 2 H), 7.43–7.49 (m, 3 H), 8.23 (d, J = 7.8 Hz, 2 H); ^{13}C NMR δ 21.3, 25.2, 36.1, 79.0, 122.2, 125.0, 126.5, 127.8, 128.2, 128.3, 131.2, 131.3, 133.2, 139.0, 156.3.

2,3,4-Triphenyl-3*H*,4*H*-quinazoline (21a) was prepared from **22a** and *N*-benzylideneaniline as a yellow solid (83%): mp 148–149 °C; ^{1}H NMR δ 5.85 (s, 1 H), 6.91–7.00 (m, 3 H), 7.06–7.12 (m, 4 H), 7.22–7.36 (m, 7 H), 7.45–7.53 (m, 3 H), 7.66–7.69 (m, 2 H); ^{13}C NMR δ 66.0, 124.2, 124.5, 125.1, 125.6, 125.7, 125.8, 126.5, 127.9, 128.1, 128.2, 128.6, 129.2, 129.6, 136.5, 141.0, 144.7, 146.2, 155.0.

2-Phenyl-3-*p*-tolyl-4-(*p*-methoxyphenyl)-3*H*,4*H*-quinazoline (21b) was prepared from **22a** and *N*-(*p*-methylbenzylidene)-*p*-methoxyaniline as a yellow solid (80%): mp 82–83 °C; ^{1}H NMR δ 2.20 (s, 3 H), 3.75 (s, 3 H), 5.76 (s, 1 H), 6.81–6.91 (m, 6 H), 7.01–7.04 (m, 1 H), 7.07–7.13 (m, 1 H), 7.20–7.30 (m, 4 H), 7.40–7.47 (m, 3 H), 7.62–7.65 (m, 2 H); ^{13}C NMR δ 20.8, 55.2, 65.6, 114.4, 124.4, 125.0, 125.6, 125.7, 126.8, 127.0, 128.0, 129.2, 129.4, 129.6, 134.4, 136.7, 137.4, 141.1, 143.8, 155.1, 159.2.

2-(1-Naphthyl)-3,4-di(*p*-tolyl)-3*H*,4*H*-quinazoline (21c) was prepared from **22c** and *N*-(*p*-methylbenzylidene)-*p*-methylaniline as a yellow solid (79%): mp 129–130 °C; ^{1}H NMR δ 2.03 (s, 3 H), 2.33 (s, 3 H), 5.83 (s, 1 H), 6.66 (d, J = 8.3 Hz, 2 H), 6.73 (d, J = 8.2 Hz, 2 H), 6.95 (d, J = 7.4 Hz, 1 H), 7.05–7.13 (m, 1 H), 7.15–7.22 (m, 3 H), 7.23–7.31 (m, 1 H), 7.37–7.47 (m, 6 H), 7.65 (d, J = 8.2 Hz, 1 H), 7.71 (d, J = 7.8 Hz, 1 H), 8.45 (d, J = 8.2 Hz, 1 H); ^{13}C NMR δ 20.7, 21.1, 66.4, 124.6, 125.1, 125.5, 125.6, 125.7, 125.9, 126.0, 126.4, 126.7, 127.8, 128.1, 128.2, 129.0, 129.2, 129.8, 131.9, 133.7, 134.2, 135.3, 137.8, 141.0, 142.5, 142.6, 155.0.

2,4-Diphenylquinazoline (24a) was prepared from **22a** and benzonitrile as a brown solid (81%): mp 119–120 °C; ^{1}H NMR δ 7.49–7.60 (m, 7 H), 7.83–7.89 (m, 3 H), 8.09–8.16 (m, 2 H), 8.62–8.71 (m, 2 H); ^{13}C NMR δ 121.7, 127.0, 128.5, 128.6, 129.1, 129.9, 130.2, 130.5, 133.5, 137.7, 138.2, 152.0, 160.2, 168.3.

2-Phenyl-4-*p*-tolylquinazoline (24b) was prepared from **22a** and *p*-methylbenzonitrile as a yellow solid (47%): mp 100–101 °C; ^{1}H NMR δ 2.50 (s, 3 H), 7.41 (d, J = 8.0 Hz, 2 H), 7.49–7.57 (m, 4 H), 7.81 (d, J = 8.0 Hz, 2 H), 7.85–7.90 (m, 1 H), 8.13–8.17 (m, 2 H), 8.68–8.72 (m, 2 H); ^{13}C NMR δ 21.5, 121.8, 126.8, 127.1, 128.5, 128.7, 129.1, 129.2, 130.2, 130.4, 133.4, 135.0, 138.3, 140.1, 152.0, 160.3, 168.3.

Isopropyl *N*-(2-methylphenyl)benzimidate (25a) was prepared from **22a** and iodomethane as a yellow solid (77%): mp 54–55 °C; ^{1}H NMR δ 1.42 (d, J = 6.2 Hz, 6 H), 2.16 (s, 3 H), 5.31–5.42 (m, 1 H), 6.45 (d, J = 7.7 Hz, 1 H), 6.81–6.90 (m, 1 H), 6.90–6.97 (m, 1 H), 7.08 (d, J = 7.1 Hz, 1 H), 7.13–7.27 (m, 5 H); ^{13}C NMR δ 18.3, 21.9, 68.4, 120.7, 122.4, 126.3, 127.8, 128.8, 129.7, 130.1, 132.2, 147.4, 156.8.

Isopropyl *N*-(2-butylphenyl)benzaimidate (25b) was prepared from **22a** and iodobutane as a yellow oil (88%): ^{1}H NMR δ 0.93 (t, J = 7.2 Hz, 3 H), 1.35–1.43 (m, 2 H), 1.43 (d, J = 6.3 Hz, 6 H), 1.55–1.65 (m, 2 H), 2.60 (t, J = 7.7 Hz, 2 H), 5.35–5.45 (m, 1 H), 6.38–6.41 (m, 1 H), 6.87–6.91 (m, 2 H), 7.12–7.35 (m, 6 H); ^{13}C NMR δ 14.0, 21.9, 22.8, 31.9, 68.3,

71.9, 121.0, 122.5, 126.2, 127.8, 129.0, 129.3, 129.6, 132.0, 133.7, 146.8, 156.5.

2-(*p*-Tolyl)-3-phenyl-3*H*,4*H*-quinazoline-4-thione (26a) was prepared from **22b** and phenyl isothiocyanate as a yellow solid (67%): mp 242–243 °C; ^{1}H NMR δ 2.25 (s, 3 H), 6.99 (d, J = 7.8 Hz, 2 H), 7.12–7.20 (m, 4 H), 7.24–7.36 (m, 3 H), 7.50–7.60 (m, 1 H), 7.80 (d, J = 4.7 Hz, 2 H), 8.81–8.85 (m, 1 H); ^{13}C NMR δ 21.2, 128.3, 128.4, 128.5, 128.8, 129.1, 129.3, 131.3, 132.9, 134.8, 139.2, 142.2, 142.4, 154.6, 190.6.

2-(1-Naphthyl)-3-phenyl-3*H*,4*H*-quinazoline-4-thione (26b) was prepared from **22c** and phenyl isothiocyanate as a yellow solid (74%): mp 179–181 °C; ^{1}H NMR δ 6.86 (d, J = 4.5 Hz, 2 H), 7.01–7.07 (m, 1 H), 7.22–7.25 (m, 2 H), 7.29 (d, J = 8.0 Hz, 1 H), 7.32–7.35 (m, 1 H), 7.42–7.51 (m, 2 H), 7.58–7.64 (m, 1 H), 7.68–7.75 (m, 3 H), 7.83–7.85 (m, 2 H), 8.89–8.92 (m, 1 H); ^{13}C NMR δ 124.3, 124.8, 126.2, 127.0, 127.3, 127.4, 128.3, 128.4, 128.7, 128.8, 129.2, 129.3, 129.5, 130.6, 131.3, 132.6, 133.0, 135.0, 141.7, 142.2, 153.6, 190.4.

X-Ray Crystallography for 4-{2-[α-[(Methoxybenzylidene)amino]phenyl]propylidene}-4*H*-3,1-benzoxazine (14a). Crystal Data: $C_{31}H_{26}N_2O_2$, M_r = 458.5, yellow plate, 0.73 × 0.33 × 0.04 mm; triclinic, P-1; a = 7.156(3) Å, b = 10.278(5) Å, c = 16.851(7) Å, α = 95.37(4)°, β = 94.34(4)°, γ = 108.71-(4)°, V = 1161(1) Å^3; T = −143 °C, D_c = 1.31 g cm^{-3}; Z = 2, F(000) = 484, $2\theta_{max}$ = 48°; 317 parameters, R = 0.127 for 1909 data with $F_o > 4\sigma(F_o)$.

Data Collection, Structure Solution and Refinement. All measurements were made with a Nicolet P4s diffractometer using graphite-monochromatized Mo Kα (λ = 0.710 73 Å) radiation. Intensities were corrected for Lorentz and polarization effects but not for absorption. The structure was solved by direct methods using SHELXS-90[21] and refined on F^2 using all data by full-matrix least-squares procedures with SHELXL-93.[22] All non-hydrogen atoms were refined with anisotropic displacement parameters. Hydrogen atoms were included in calculated positions with isotropic displacement parameters 1.3 times the isotropic equivalent of their carrier carbons. The function minimized was $\sum w(F_o^2 - F_c^2)$, with $w = [\sigma^2((F_o^2) + 0.73P^2 + 4.30P]^{-1}$ where $P = [\max(F_o)^2 + 2F_c^2]/3$. Full tables of atom coordinates, thermal parameters, bond lengths and bond angles and structure factors are available from P.J.S. and have been deposited with the Cambridge Crystallographic Data Base.

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