A Journal of the Gesellschaft Deutscher Chemiker

Angewandte Chemie

GDCh

International Edition

www.angewandte.org

Accepted Article

Title: α-Aminoxy Acid Auxiliary Enabled Intermolecular Radical γ-C(sp3)-H Functionalization of Ketones

Authors: Heng Jiang and Armido Studer

To be cited as: *Angew. Chem. Int. Ed.* 10.1002/anie.201712066
Angew. Chem. 10.1002/ange.201712066

Link to VoR: http://dx.doi.org/10.1002/anie.201712066
http://dx.doi.org/10.1002/ange.201712066

WILEY-VCH

α-Aminoxy Acid Auxiliary Enabled Intermolecular Radical γ-C(sp^3)–H Functionalization of Ketones

Heng Jiang and Armido Studer*

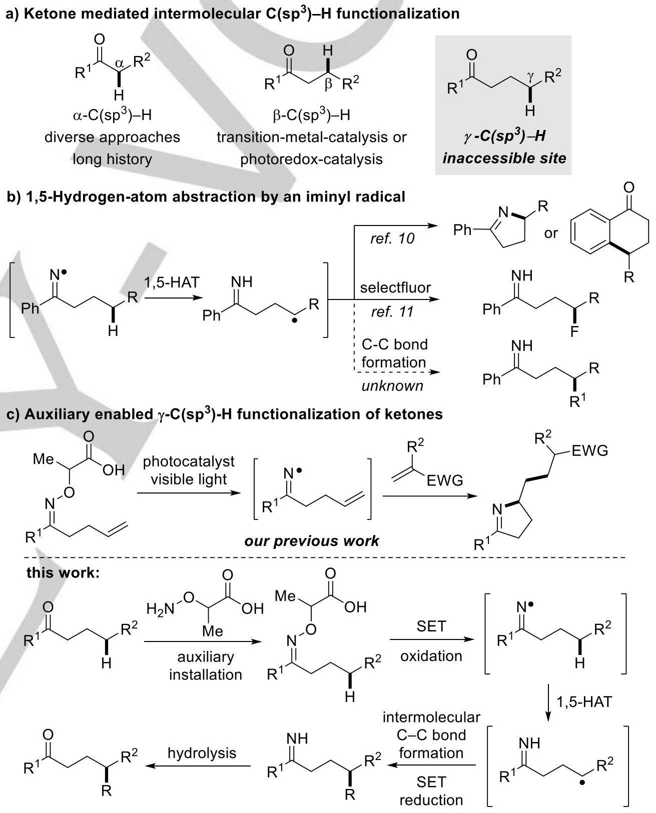
Dedication ((optional))

Abstract: A method for site specific intermolecular γ-C(sp^3)–H functionalization of ketones has been developed using an α-aminoxy acid auxiliary applying photoredox catalysis. Regioselective activation of an inert C–H bond is achieved via 1,5-hydrogen atom abstraction by an oxidatively generated iminyl radical. Tertiary and secondary C-radicals thus formed at the γ-position of the imine functionality undergo radical conjugate addition to various Michael acceptors to provide after reduction and imine hydrolysis the corresponding γ-functionalized ketones.

Ketones are valuable substrates in organic synthesis due to their well understood and broad reactivity.[1] α-C(sp^3)–H bond functionalization of ketones, typically achieved via their enolate intermediates, has been used successfully during the last century (Scheme 1a, left).[2] The non-activated more challenging ketone β-C(sp^3)–H bond could be functionalized using Pd-catalyzed directed C–H activation with imine type auxiliaries or other transient directing groups.[3,4] Synergistic photoredox and enamine catalysis has been successfully used to activate β-C(sp^3)–H bonds in cyclic ketones through single electron oxidation of in situ formed enamines and subsequent β-C(sp^3)–H deprotonation (Scheme 1a, middle).[5] However, an efficient strategy for intermolecular γ-C(sp^3)–H bond functionalization of ketones has not been disclosed to date (Scheme 1a, right).[6]

A reliable approach for regioselective C(sp^3)–H bond functionalization is the 1,5-hydrogen atom transfer (HAT) to a heteroatom centered radical to generate the corresponding translocated C-radical that can be further functionalized by established radical methodology.[7] Recent advances in that area involve photoredox catalyzed distal C(sp^3)–H functionalization of amides, amines and alcohols through 1,5-HAT and intermolecular C–C bond formation.[8] Iminyl radicals, that are versatile intermediates for construction of N-heterocycles,[9] have been shown to engage in 1,5-hydrogen atom abstractions followed by cyclization[10] or fluorination[11] of the translocated C-radicals (Scheme 1b). To our knowledge, C–C bond formation by intermolecular trapping of C-radicals generated by 1,5-HAT to iminyl radicals has not been reported to date.

We envisioned to apply such an HAT as key step for intermolecular γ-C(sp^3)–H bond functionalization of ketones. Leonori *et al.* and our group independently reported a method for clean generation of iminyl radicals from α-imino-oxy acids by photoredox catalysis.[12] The cascade affords diverse pyrrolines through sequential intramolecular carboimination, radical conjugate addition and reduction (Scheme 1c, top). We conceived that α-imino-oxy acids could also be used as substrates for γ-C(sp^3)–H functionalization of ketones through a redox neutral cascade involving two single electron transfer (SET) steps (Scheme 1c, bottom).[13]



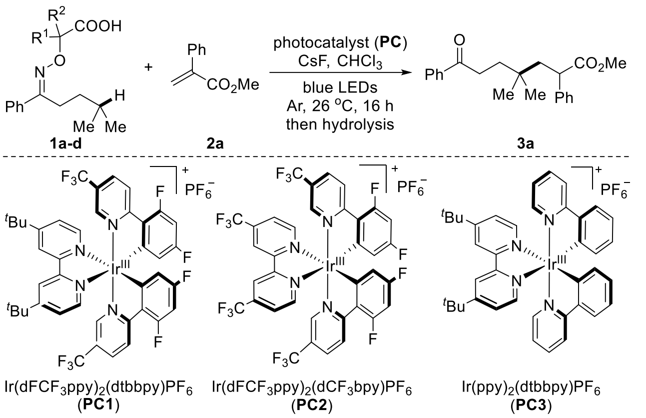
Scheme 1. C(sp^3)–H functionalization of ketones.

α-Imino-oxy acids readily prepared by condensation of ketones with α-aminoxy acids first react via single electron oxidation, decarboxylation and acetaldehyde fragmentation to the corresponding iminyl radicals. HAT from the distal C(sp^3)–H bond to the iminyl radical leads to the γ-C-radical that can be trapped intermolecularly by C–C bond formation with a Michael acceptor to give after reduction and imine hydrolysis a γ-C(sp^3)–H functionalized ketone. Since the overall cascade requests an initial SET oxidation step for iminyl radical generation and an SET reduction step of the Michael adduct radical, the whole process is redox-neutral and should be realizable with an appropriate redox catalyst in the absence of any external oxidant or reductant.[14] Herein we report first results by using an iridium complex based photoredox catalyst.[15,16,17]

---

[*] Dr. H. Jiang, Prof. Dr. A. Studer
Organisch-Chemisches Institut, Westfälische Wilhelms-Universität
Correnssstraß 40, 48149 Münster (Germany)
E-mail: studer@uni-muenster.de
Supporting information for this article is given via a link at the end of the document.

Table 1. Reaction optimization.

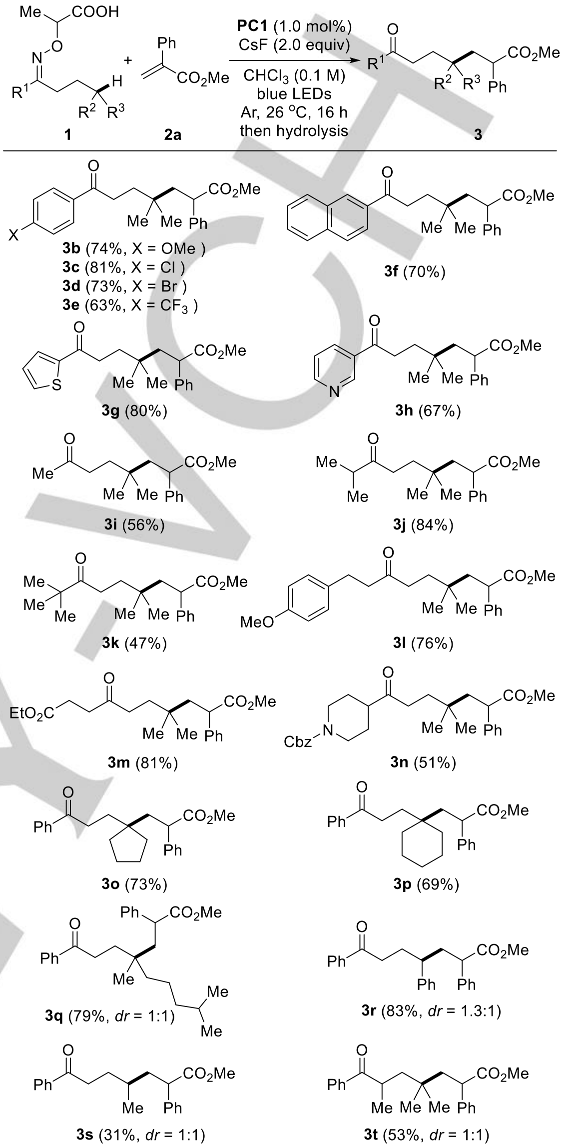


entry[a]	photocatalyst	R^1, R^2	yield (%)[b]
1	**PC1**	H, H (**1a**)	51
2	**PC1**	Me, Me (**1b**)	73
3	**PC1**	H, Me (**1c**)	81 (75)[c]
4	**PC1**	H, Ph (**1d**)	77
5	**PC2**	H, Me (**1c**)	11
6	**PC3**	H, Me (**1c**)	31
7	–	H, Me (**1c**)	n.d.
8[d]	**PC1**	H, Me (**1c**)	n.d.
9[e]	**PC1**	H, Me (**1c**)	n.d.

[a] Reaction conditions: A mixture of **1** (0.1 mmol, 1.0 equiv), **2a** (0.2 mmol, 2.0 equiv), photocatalyst (0.001 mmol, 1.0 mol%), base (0.2 mmol, 2.0 equiv) in $CHCl_3$ (1.0 mL, 0.1 M) was irradiated by a 10 W blue LEDs at 26 °C for 24 h. For imine hydrolysis, 1.0 mL H_2O was added and the mixture was stirred for 30 minutes at room temperature. [b] The yield was determined by ^{1}H NMR analysis using CH_2Br_2 as an internal standard. [c] Isolated yield at 0.2 mmol scale. [d] Conducted in the absence of CsF. [e] Conducted in the dark.

Optimization studies were conducted using four different α-aminoxy acids as auxiliaries, three Ir-based photocatalysts (**PC1**, **PC2**, and **PC3**) in combination with 3-methylbutyl phenyl ketone and methyl 2-phenylacrylate (**2a**) as radical acceptor. Oxime ethers **1a**-**d** were prepared by condensation of the corresponding α-aminoxy acid with 3-methylbutyl phenyl ketone. Blue LED light irradiation of a $CHCl_3$ solution containing **1a**, **2a**, **PC1** (1 mol%) and CsF for 16 h afforded the γ-C(sp^3)–H functionalized ketone **3a** in 51% yield (Table 1, entry 1). With 2-imino-oxy isobutyric acid **1b**, **3a** was obtained in 73% yield (Table 1, entry 2). A further improvement was achieved by using 2-aminoxy propionic acid as the auxiliary (81%, Table 1, entry 3). The 2-imino-oxy 2-phenylacetic acid **1d** was also a competent substrate providing a comparable yield (77%, Table 1, entry 4). Other solvents and potassium or sodium salts such as K_2CO_3, KOAc, NaOAc, and Na_2HPO_4 provided worse results (see Supporting Information). The catalysts **PC2** and **PC3** led to significantly lower yields (Table 1, entries 5, 6). In control experiments, **3a** was not detected in the absence of either photocatalyst or CsF (Table 1, entries 7, 8). As a signature of a photoredox catalyzed process, this cascade did not proceed in the dark (Table 1, entry 9).

Table 2. Variation of the α-imino-oxy acids.[a],[b]

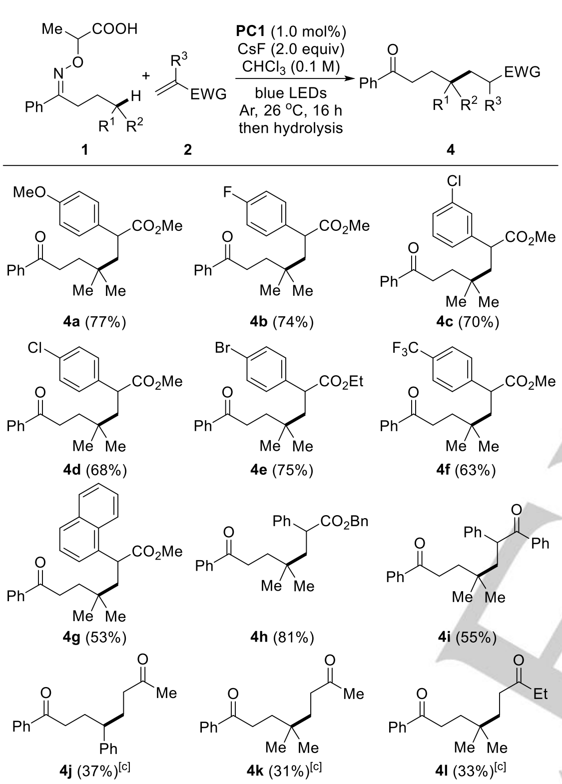


[a] Reaction conditions: A mixture of **1** (0.2 mmol, 1.0 equiv), **2a** (0.4 mmol, 2.0 equiv), **PC1** (0.002 mmol, 1.0 mol%), CsF (0.4 mmol, 2.0 equiv) in $CHCl_3$ (2.0 mL, 0.1 M) was irradiated by a 10 W blue LED at 26 °C for 16 h. For imine hydrolysis, 1.0 mL H_2O was added and the mixture was stirred for 30 minutes at room temperature. [b] Isolated yields are provided.

Under optimized conditions, we examined the scope with respect to the ketone moiety keeping **2a** as the radical acceptor (Table 2). The phenyl group in the oxime ether in **1c** could be replaced by electron rich or electron poor para-substituted phenyl groups and the targeted γ-C(sp^3)–H functionalized ketones **3b**-**e** were obtained in good yields. 2-Naphthyl, 2-thienyl and 3-pyridyl were also tolerated as R^1-substituents to afford **3f**-**h** in 67-80% yields. Importantly, the cascade is not restricted to aryl alkyl oxime ethers and di-alkyl oxime ethers also work. For instance, the Me, ^{i}Pr and ^{t}Bu-substituted oxime ethers provided **3i**-**k** in 47-84% yield. Functional group tolerance was documented by the successful transformation of anisole (**3l**), ester (**3m**) and Cbz-piperidine (**3n**) containing substrates (51-

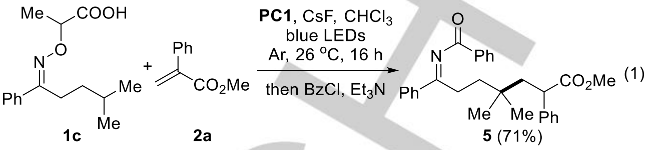
81%). The *tert*-alkyl moiety to be functionalized was varied next and we found that C–H bonds in cyclic and acyclic systems could be functionalized (**3o**-**q**). We further showed that secondary benzylic C–H bonds can be modified, as documented by the preparation of **3r** (83%). Due to the lower stability of a secondary alkyl radical and accordingly less efficient 1,5-HAT, yield for methylene C–H bond functionalization was significantly lower (**3s**, 31%). As expected, in these two cases, C–C bond formation occurred with poor diastereoselectivity and γ-C(sp^3)–H alkylation of an α-substituted ketone also proceeded without any selectivity (see **3t**).

Table 3. Variation of the radical acceptor.[a],[b]

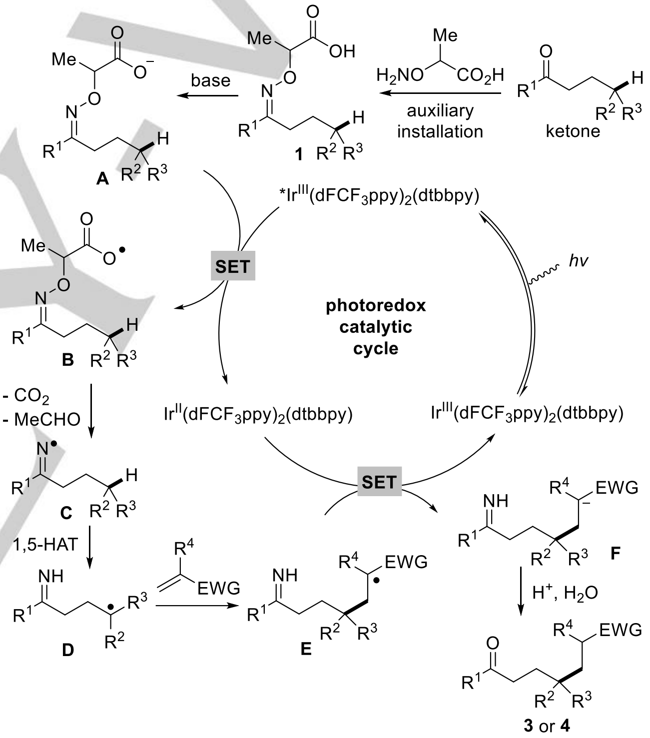


[a] Reaction conditions: A mixture of **1** (0.2 mmol, 1.0 equiv), **2** (0.4 mmol, 2.0 equiv), **PC1** (0.002 mmol, 1.0 mol%), CsF (0.4 mmol, 2.0 equiv) in $CHCl_3$ (2.0 mL, 0.1 M) was irradiated by a 10 W blue LED at 26 °C for 16 h. For imine hydrolysis, 1.0 mL H_2O was added and the mixture was stirred for 30 minutes at room temperature. [b] Isolated yields are provided. [c] DCM was used instead of $CHCl_3$ and 3.0 equiv Michael acceptor was used.

We next varied the radical acceptor mainly using **1c** as the substrate. Various 2-arylacrylates show good reactivity and the ketones **4a**-**g** were obtained in 53-77% yield (Table 3). The methyl ester in **2a** can be replaced by a benzyl ester and γ-C(sp^3)–H modification worked with similar efficiency (**4h**, 81%). Phenyl 1-phenylvinyl ketone is also a competent radical acceptor providing **4i** in 55% yield. In addition, methyl vinyl ketone and ethyl vinyl ketone reacted with **1c** to the corresponding ketones **4k** (31%) and **4l** (33%), albeit yield significantly decreased. The same observation was made for functionalization of the secondary benzylic C–H bond with methyl vinyl ketone (see **4j**). These alkyl vinyl ketones are known to readily undergo polymerization what is likely the reason for the observed lower yields. Other Michael acceptors such as acrylonitrile, methyl acrylate and nitroethene did not engage in the remote functionalization.



Notably, the imine functionality in the crude products can be conserved by in situ benzoyl protection. As an example, Bz-imine **5** was obtained in 71% yield in the reaction of **1c** with **2a** by adding benzoyl chloride to the crude product after visible light irradiation further documenting the synthetic value of the method since the activated imine functionality in **5** offers a rich downstream chemistry (Eq. 1).[17]



Scheme 2. Suggested mechanism.

The suggested mechanism is depicted in Scheme 2. Photoexcitation of Ir^{III}(dFCF$_3$ppy)$_2$(dtbbpy)PF$_6$ by visible light leads to the excited *Ir^{III}(dFCF$_3$ppy)$_2$(dtbbpy)PF$_6$ complex, which is SET reduced by carboxylate **A**, formed by deprotonation of substrate **1**, to generate the carboxyl radical **B** along with Ir^{II}(dFCF$_3$ppy)$_2$(dtbbpy)PF$_6$. Sequential fragmentation of CO_2 and acetaldehyde from **B** generates the iminyl radical **C**. Hydrogen transfer from the distal C–H bond to the iminyl radical provides C-radical **D** which then reacts via intermolecular conjugate addition to give the adduct radical **E**. The photoredox cycle is closed through SET reduction of **E** by Ir^{II}(dFCF$_3$ppy)$_2$(dtbbpy)PF$_6$ to provide **F** thereby regenerating the ground-state photocatalyst Ir^{III}(dFCF$_3$ppy)$_2$(dtbbpy)PF$_6$. Protonation and imine hydrolysis of **F** eventually afford **3** or **4**.

In summary, we have developed a photoredox catalyzed γ-C(sp^3)–H functionalization of ketones using the readily accessible α-aminoxy propionic acid as an auxiliary. Condensation of a ketone with the auxiliary provides the substrate oxime ether which upon SET oxidation with an iridium photocatalyst provides the corresponding iminyl radical. H-atom abstraction from a distal C–H bond to the iminyl radical allows for site selective generation of secondary and tertiary alkyl radicals, which undergo conjugate addition to provide after reduction and imine hydrolysis the corresponding γ-functionalized ketones. The overall redox neutral transformation proceeds under mild conditions and a wide range of functional groups are tolerated.

Acknowledgements

This work was supported by the Alexander von Humboldt Foundation (postdoctoral fellowship to H. J.). We thank Ph.D. candidate Julia Wellmann for providing some starting materials.

Conflict of Inerest

The authors declare no conflict of interest.

Keywords: C-H bond functionalization • photoredox chemistry • iminyl radical • redox-neutral • ketone

[1] F. A. Carey, R. J. Sundberg, *Advanced Organic Chemistry: Part B: Reactions and Synthesis*; Springer: New York, 2001.

[2] a) S. Mukherjee, J. W. Yang, S. Hoffmann, B. List, *Chem. Rev.* **2007**, *107*, 5471; b) D. A. Evans, G. Helmchen, M. Rüping, *Asymmetric Synthesis−The Essentials*; Wiley-VCH: Weinheim, 2006.

[3] Representative reviews on β-C(sp^3)-H functionalization of ketones: a) Z. Huang, H. N. Lim, F. Mo, M. C. Young, G. Dong, *Chem. Soc. Rev.* **2015**, *44*, 7764; b) Z. Huang, G. Dong, *Tetrahedron Lett.* **2014**, *55*, 5869.

[4] Transition-metal catalyzed β-C(sp^3)-H functionalization of ketones: a) R.-Y. Zhu, L.-Y. Liu, H. Park, K. Hong, Y. Wu, C. H. Senanayake, J.-Q. Yu, *J. Am. Chem. Soc.* **2017**, *139*, 16080; b) K. Hong, H. Park, J.-Q. Yu, *ACS Catal.* **2017**, *7*, 6938; c) R.-Y. Zhu, L.-Y. Liu, J.-Q. Yu, *J. Am. Chem. Soc.* **2017**, *139*, 12394; d) F.-L. Zhang, K. Hong, T.-J. Li, H. Park, J.-Q. Yu, *Science* **2016**, *351*, 252; e) Z. Huang, G. Dong, *J. Am. Chem. Soc.* **2013**, *135*, 17747.

[5] Photoredox catalyzed β-C(sp^3)-H functionalization of ketones: a) M. Okada, T. Fukuyama, K. Yamada, I. Ryu, D. Ravelli, M. Fagnoni, *Chem. Sci.* **2014**, *5*, 2893; b) M. T. Pirnot, D. A. Rankic, D. B. C. Martin, D. W. C. MacMillan, *Science* **2013**, *339*, 1593; c) F. R. Petronijević, M. Nappi, D. W. C. MacMillan, *J. Am. Chem. Soc.* **2013**, *135*, 18323.

[6] Only one example of γ-arylation of a ketone was observed lacking any β-C(sp^3)-H bonds in the substrate. See ref. 4d

[7] For selected reviews, see: a) J.-R. Chen, X.-Q. Hu, L.-Q. Lu, W.-J. Xiao, *Chem. Soc. Rev.* **2016**, *45*, 2044; b) S. Chiba, H. Chen, *Org. Biomol. Chem.* **2014**, *12*, 4051; c) J. Robertson, J. Pillai, R. K. Lush, *Chem. Soc. Rev.* **2001**, *30*, 94; d) P. Mackiewicz, R. Furstoss, *Tetrahedron* **1978**, *34*, 3241; e) M. E. Wolff, *Chem. Rev.* **1963**, *63*, 55. For selected recent examples on radical 1,5-H shift: f) P. Becker, T. Duhamel, C. J. Stein, M. Reiher, K. Muñiz, *Angew. Chem. Int. Ed.* **2017**, *56*, 8004; g) E. A. Wappes, S. C. Fosu, T. C. Chopko, D. A. Nagib, *Angew. Chem Int. Ed.* **2016**, *55*, 9974; h) C. Martínez, K. Muñiz, *Angew. Chem. Int. Ed.* **2015**, *54*, 8287; i) Q. Qin, S. Yu, *Org. Lett.* **2015**, *17*, 1894.

[8] a) D.-F. Chen, J. C. K. Chu, T. Rovis, *J. Am. Chem. Soc.* **2017**, *139*, 14897; b) W. Yuan, Z. Zhou, L. Gong, E. Meggers, *Chem. Commun.* **2017**, *53*, 8964; c) J. C. K. Chu, T. Rovis, *Nature* **2016**, *539*, 272; d) G. J. Choi, Q. Zhu, D. C. Miller, C. J. Gu, R. R. Knowles, *Nature* **2016**, *539*, 268; e) J. Zhang, Y. Li, F. Zhang, C. Hu, Y. Chen, *Angew. Chem. Int. Ed.* **2016**, *55*, 1872; f) C. Wang, K. Harms, E. Meggers, *Angew. Chem. Int. Ed.* **2016**, *55*, 13495. For a highlight review, see: X.-Q. Hu, J.-R. Chen, W.-J. Xiao, *Angew. Chem. Int. Ed.* **2017**, *13*, 1960.

[9] For reviews on iminyl radicals, see: a) M. M. Jackman, Y. Cai, S. L. Castle, *Synthesis* **2017**, *49*, 1785; b) T. Xiong, Q. Zhang, *Chem. Soc. Rev.* **2016**, *45*, 3069; c) J. C. Walton, *Molecules* **2016**, *21*, 63; d) H.-W. Huang, H.-W. Cai, G.-J. Deng, *Org. Biomol. Chem.* **2016**, *14*, 1519; e) X. Zhu, S. Chiba, *Chem. Soc. Rev.* **2016**, *45*, 4504; f) J. C. Walton, *Acc. Chem. Res.* **2014**, *47*, 1406; g) S. Z. Zard, *Chem. Soc. Rev.* **2008**, *37*, 1603. For recent selected examples on generation of iminyl radicals by photoredox catalysis: h) X.-Y. Yu, J.-R. Chen, P.-Z. Wang, M.-N. Yang, D. Liang, W.-J. Xiao, DOI: 10.1002/anie.201710618; i) L. Li, H. Chen, M. Mei, L. Zhou, *Chem. Commun.* **2017**, *53*, 11544; j) J. Davies, S. G. Booth, S. Essafi, R. W. A. Dryfe, D. Leonori, *Angew. Chem. Int. Ed.* **2015**, *54*, 14017; k) H. Jiang, X. An, K. Tong, T. Zheng, Y. Zhang, S. Yu, *Angew. Chem. Int. Ed.* **2015**, *54*, 4055.

[10] a) W. Shu, C. Nevado, *Angew. Chem. Int. Ed.* **2017**, *56*, 1881; b) W. Shu, A. Lorente, E. Gómez-Bengoa, C. Nevado, *Nat. Commun.* **2017**, *8*, 13832; c) Y. Li, R. Mao, J. Wu, *Org. Lett.* **2017**, *19*, 4472; d) L. Zhang, G. Y. Ang, S. Chiba, *Org. Lett.* **2011**, *13*, 1622; e) A. R. Forrester, R. J. Napier, R. H. Thomson, *J. Chem. Soc. Perkin 1* **1981**, 984; f) A. R. Forrester, M. Gill, R. J. Napier, R. H. Thomson, *J. Chem. Soc. Perkin 1* **1978**, 632. From aminidyl radicals or imidate radicals: g) E. A. Wappes, K. M. Nakafuku, D. A. Nagib, *J. Am. Chem. Soc.* **2017**, *139*, 10204; h) H. Chen, S. Chiba, *Org. Biomol. Chem.* **2014**, *12*, 42; i) H. Chen, S. Sanjaya, Y.-F. Wang, S. Chiba, *Org. Lett.* **2013**, *15*, 212; j) Y.-F. Wang, H. Chen, X. Zhu, S. Chiba, *J. Am. Chem. Soc.* **2012**, *134*, 11980.

[11] During the preparation of this manuscript, Leonori *et al.* reported the γ-C(sp^3)–H fluorination of ketones through HAT of iminyl radicals. See: E. M. Dauncey, S. P. Marcillo, J. J. Douglas, N. S. Sheikh, D. Leonori, DOI: 10.1002/anie.201710790.

[12] a) J. Davies, N. S. Sheikh, D. Leonori, *Angew. Chem. Int. Ed.* **2017**, *56*, 13361; b) H. Jiang, A. Studer, *Angew. Chem. Int. Ed.* **2017**, *56*, 12273.

[13] a) M. Yan, J. C. Lo, J. T. Edwards, P. S. Baran, *J. Am. Chem. Soc.* **2016**, *138*, 12692; b) A. Studer, D. P. Curran, *Angew. Chem. Int. Ed.* **2016**, *55*, 58; c) A. Studer, D. P. Curran, *Nat. Chem.* **2014**, *6*, 765.

[14] a) N. Z. Burns, P. S. Baran, R. W. Hoffmann, *Angew. Chem. Int. Ed.* **2009**, *48*, 2854. b) T. Newhouse, P. S. Baran, R. W. Hoffmann, *Chem. Soc. Rev.* **2009**, *38*, 3010.

[15] Selected reviews on photoredox catalysis, see: a) J. Twilton, C. Le, P. Zhang, M. H. Shaw, R. W. Evans, D. W. C. MacMillan, *Nat. Rev. Chem.* **2017**, *1*, 0052; b) J. C. Tellis, C. B. Kelly, D. N. Primer, M. Jouffroy, N. R. Patel, G. A. Molander, *Acc. Chem. Res.* **2016**, *49*, 1429; c) M. H. Shaw, J. Twilton, D. W. C. MacMillan, *J. Org. Chem.* **2016**, *81*, 6898; d) K. L. Skubi, T. R. Blum, T. P. Yoon, *Chem. Rev.* **2016**, *116*, 10035; e) N. A. Romero, D. A. Nicewicz, *Chem. Rev.* **2016**, *116*, 10075; f) D. Staveness, I. Bosque, C. R. J. Stephenson, *Acc. Chem. Res.* **2016**, *49*, 2295; g) C. K. Prier, D. A. Rankic, D. W. C. MacMillan, *Chem. Rev.* **2013**, *113*, 5322; h) J. Xuan, W.-J. Xiao, *Angew. Chem. Int. Ed.* **2012**, *51*, 6828; i) J. M. R. Narayanam, C. R. J. Stephenson, *Chem. Soc. Rev.* **2011**, *40*, 102.

[16] Selected examples on photoredox decarboxylation: a) L. Candish, E. A. Standley, A. Gómez-Suárez, S. Mukherjee, F. Glorius, *Chem. Eur. J.* **2016**, *22*, 9971; b) L. Candish, L. Pitzer, A. Gómez-Suárez, F. Glorius, *Chem. Eur. J.* **2016**, *22*, 4753; c) C. C. Nawrat, C. R. Jamison, Y. Slutskyy, D. W. C. MacMillan, L. E. Overman, *J. Am. Chem. Soc.* **2015**, *137*, 11270; d) S. Ventre, F. R. Petronijevic, D. W. C. MacMillan, *J. Am. Chem. Soc.* **2015**, *137*, 5654; e) J. D. Griffin, M. A. Zeller, D. A. Nicewicz, *J. Am. Chem. Soc.* **2015**, *137*, 11340; f) F. Le Vaillant, T.

Courant, J. Waser, *Angew. Chem. Int. Ed.* **2015**, *54*, 11200; g) Q.-Q. Zhou, W. Guo, W. Ding, X. Xu, X. Chen, L.-Q. Lu, W.-J. Xiao, *Angew. Chem. Int. Ed.* **2015**, *54*, 11196; h) L. Chu, C. Ohta, Z. Zuo, MacMillan, D. W. C. *J. Am. Chem. Soc.* **2014**, *136*, 10886; i) Z. Zuo, D. W. C. MacMillan, *J. Am. Chem. Soc.* **2014**, *136*, 5257; j) Z. Zuo, D. T. Ahneman, L. Chu, J. A. Terrett, A. G. Doyle, D. W. C. MacMillan, *Science* **2014**, *345*, 437; k) A. Noble, D. W. C. MacMillan, *J. Am. Chem. Soc.* **2014**, *136*, 11602; l) J. Liu, Q. Liu, H. Yi, C. Qin, R. Bai, X. Qi, Y. Lan, A. Lei, *Angew. Chem. Int. Ed.* **2014**, *53*, 502.

[17] J. Xie, H. Jin, A. S. K. Hashmi, *Chem. Soc. Rev.* **2017**, *46*, 5193.

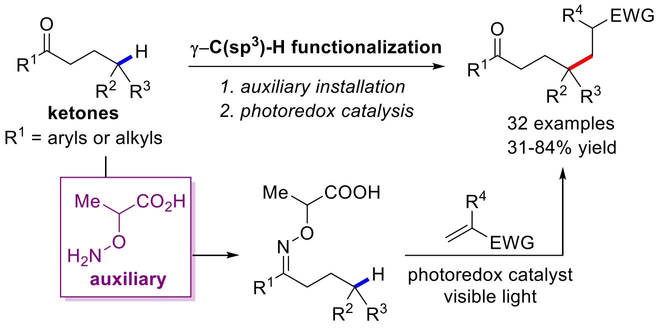
[18] W. Tang, X. Zhang, *Chem. Rev.* **2003**, *103*, 3029.

10.1002/anie.201712066

Entry for the Table of Contents (Please choose one layout)

Layout 2:

COMMUNICATION



Auxiliary and Light! A method for site specific intermolecular γ-C(sp^3)-H functionalization of ketones has been developed using an α-aminoxy acid auxiliary applying photoredox catalysis.

*H. Jiang, A. Studer**

Page No. – Page No.

α-Aminoxy Acid Auxiliary Enabled Intermolecular Radical γ-C(sp^3)–H Functionalization of Ketones