University of Groningen

Catalytic asymmetric carbon-carbon bond forming methodologies for synthesis of chiral N-containing heterocycles and chiral carboxamides

Guo, Yafei

DOI:

[10.33612/diss.147535855](https://doi.org/10.33612/diss.147535855)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version

Publisher's PDF, also known as Version of record

Publication date:

2020

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Guo, Y. (2020). *Catalytic asymmetric carbon-carbon bond forming methodologies for synthesis of chiral N-containing heterocycles and chiral carboxamides*. [Thesis fully internal (DIV), University of Groningen]. University of Groningen. <https://doi.org/10.33612/diss.147535855>

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

**Catalytic asymmetric carbon-carbon bond forming
methodologies for synthesis of chiral *N*-containing
heterocycles and chiral carboxamides**

Yafei Guo

The work described in this thesis was carried out at Stratingh Institute for Chemistry, University of Groningen (The Netherlands)

This work was financially supported by the European Research Council (Grant No.773264, LACOPAROM), the Netherlands Organization for Scientific Research (Vici grant 491 724.017.003) and China Scholarship Council (CSC)

Printed by Ipskamp Printing, Enschede, the Netherlands

university of
 groningen

Catalytic asymmetric carbon-carbon bond forming methodologies for synthesis of chiral *N*-containing heterocycles and chiral carboxamides

PhD thesis

to obtain the degree of PhD at the
University of Groningen
on the authority of the
Rector Magnificus prof. E. Sterken
and in accordance with
the decision by the College of Deans.

This thesis will be defended in public on

Tuesday 22 December 2020 at 11:00 hours

by

Yafei Guo

born on 24 June 1990
in Henan, China

Supervisors

Prof. S. R. Harutyunyan

Prof. K. Barta

Assessment committee

Prof. J. G. Roelfes

Prof. J. H. van Maarseven

Prof. F. P. J. T. Rutjes

To my dear wife and daughter

Table of contents

Chapter 1: Copper catalyzed alkylation of heterocyclic acceptors with organometallics	1
1.1 Introduction	2
1.2 Outline of this thesis	14
1.3 References	15
Chapter 2: Highly enantioselective catalytic addition of Grignard reagents to <i>N</i> -heterocyclic acceptors	17
2.1 Introduction	18
2.2 Results and discussions	21
2.3 Conclusions	27
2.4 Experimental section	28
2.5 References	53
Chapter 3: Catalytic asymmetric dearomatization of <i>N</i> -acylpyridinium ions with Grignard reagents	55
3.1 Introduction	56
3.2 Results and discussions	59
3.3 Conclusions	66
3.4 Experimental section	66
3.5 References	85
Chapter 4: Catalytic regio- and enantioselective alkylation of conjugated dienyl amides	87
4.1 Introduction	88
4.2 Results and discussions	89
4.3 Conclusions	94
4.4 Experimental section	95
4.5 References	110
Chapter 5: Lewis acid-driven control of regio- and enantioselectivities of Cu-catalyzed conjugate additions of Grignard reagents to bifunctional Michael acceptors	112
5.1 Introduction	113
5.2 Results and discussions	116

5.3 Conclusions	120
5.4 Experimental section	120
5.5 References	124
Summary	126
Samenvatting	128
List of abbreviations	130
Acknowledgements	131