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RESEARCH INTERESTS

Development of new reagents and methods for organic synthesis, with an emphasis on asymmetric catalysis; elucidation of reaction mechanisms.

EXPERIENCE

- 2007–present **Firmenich Professor of Chemistry**
Massachusetts Institute of Technology
- 1999–2007 **Professor of Chemistry**
Massachusetts Institute of Technology
- 1998–1999 **Associate Professor of Chemistry**
Massachusetts Institute of Technology
- 1993–1998 **Assistant Professor of Chemistry**
Massachusetts Institute of Technology
- 1991–1993 **Postdoctoral fellow with Professor Robert H. Grubbs**
California Institute of Technology
- 1985–1991 **Graduate student with Professor David A. Evans**
Harvard University
- 1984–1985 **Undergraduate student with Professor K. Barry Sharpless**
Massachusetts Institute of Technology

EDUCATION

- 1991 Ph.D., Chemistry, Harvard University
- 1985 B.S., Chemistry, Massachusetts Institute of Technology

AWARDS AND HONORS

- 2007 **Fellow, American Academy of Arts and Sciences**
- 2007 **Catalysis Science Award**, Mitsui Chemicals
- 2006 **Mukaiyama Award**, Society of Synthetic Organic Chemistry of Japan
- 2005 **Fellow, Royal Society of Chemistry**
- 2004 **Corey Award**, American Chemical Society
- 2001 **Springer Award in Organometallic Chemistry**
- 2000 **School of Science Undergraduate Teaching Prize**, Massachusetts Institute of Technology
- 2000 **Chan Memorial Award in Organic Chemistry**
- 1999 **Innovation Recognition Award**, Union Carbide
- 1998 **Bristol-Myers Squibb Award**
- 1998 **Cope Scholar Award**, American Chemical Society
- 1998 **Synthetic Organic Chemistry Award**, Pfizer
- 1997 **Camille Dreyfus Teacher-Scholar Award**
- 1997 **Alfred P. Sloan Research Fellow**
- 1997 **Chemistry Scholar Award**, Glaxo Wellcome
- 1996 **Lilly Grantee Award**, Eli Lilly
- 1996 **Cottrell Scholar Award**, Research Corporation
- 1995 **American Cancer Society Junior Faculty Research Award**
- 1994 **National Science Foundation Young Investigator Award**
- 1993 **Camille and Henry Dreyfus Foundation New Faculty Award**

PUBLICATIONS

- (166) **Applications of Aza- and Phosphaferrocenes and Related Compounds in Asymmetric Catalysis**
Submitted.
Marion, N. M.; Fu, G. C.
- (165) **Phosphine-Catalyzed Enantioselective Synthesis of Oxygen Heterocycles**
Angew. Chem., Int. Ed., accepted.
Chung, Y. K.; Fu, G. C.
- (164) **Catalytic Asymmetric Cycloaddition of Ketenes and Nitroso Compounds: Enantioselective Synthesis of α -Hydroxycarboxylic Acid Derivatives**
Angew. Chem., Int. Ed., accepted.
Dochnahl, M.; Fu, G. C.
- (163) **Catalytic Asymmetric Cross-Couplings of Racemic α -Bromoketones with Arylzinc Reagents**
Angew. Chem., Int. Ed., accepted.
Lundin, P. M.; Esquivias, J.; Fu, G. C.
- (162) **The Development of Versatile Methods for Palladium-Catalyzed Coupling Reactions of Aryl Electrophiles Through the Use of $P(t\text{-Bu})_3$ and PCy_3 as Ligands**
Acc. Chem. Res. **2008**, *41*, 1555–1564.
Fu, G. C.
- (161) **Nickel-Catalyzed Negishi Cross-Couplings of Secondary Nucleophiles with Secondary Propargylic Electrophiles at Room Temperature**
Angew. Chem., Int. Ed. **2008**, *47*, 9334–9336.
Smith, S. W.; Fu, G. C.
- (160) **Nickel-Catalyzed Asymmetric Cross-Couplings of Racemic Propargylic Halides with Arylzinc Reagents**
J. Am. Chem. Soc. **2008**, *130*, 12645–12647.
Smith, S. W.; Fu, G. C.
- (159) **Enantioselective Nucleophilic Catalysis: The Synthesis of Aza- β -Lactams via [2+2] Reactions of Ketenes with Azo Compounds**
Angew. Chem., Int. Ed. **2008**, *47*, 7048–7050.
Berlin, J. M.; Fu, G. C.
- (158) **Enantioselective Alkyl–Alkyl Suzuki Cross-Couplings of Unactivated Homobenzylic Halides**
J. Am. Chem. Soc. **2008**, *130*, 6694–6695.
Saito, B.; Fu, G. C.
- (157) **Catalytic Asymmetric Hiyama Cross-Couplings of Racemic α -Bromo Esters**
J. Am. Chem. Soc. **2008**, *130*, 3302–3303.
Dai, X.; Strotman, N. A.; Fu, G. C.
- (156) **Nickel-Catalyzed Asymmetric Negishi Cross-Couplings of Secondary Allylic Chlorides with Alkylzincs**
J. Am. Chem. Soc. **2008**, *130*, 2756–2757.
Son, S.; Fu, G. C.
- (155) **Synthesis and Resolution of Planar-Chiral Derivatives of 4-(Dimethylamino)pyridine**
Adv. Syn. Catal. **2007**, *349*, 2345–2352.
Wurz, R. P.; Lee, E. C.; Ruble, J. C.; Fu, G. C.
- (154) **Copper-Catalyzed Asymmetric N-H Insertion Reactions: Couplings of Diazo Compounds with Carbamates to Generate α -Amino Acids**
J. Am. Chem. Soc. **2007**, *129*, 12066–12067.
Lee, E. C.; Fu, G. C.
- (153) **Intramolecular Heck Reactions of Unactivated Alkyl Halides**
J. Am. Chem. Soc. **2007**, *129*, 11340–11341.
Firmansjah, L.; Fu, G. C.

- (152) **Alkyl–Alkyl Suzuki Cross-Couplings of Unactivated Secondary Alkyl Halides at Room Temperature**
J. Am. Chem. Soc. **2007**, *129*, 9602–9603.
Saito, B.; Fu, G. C.
- (151) **Enantioselective Synthesis of Protected Amines by the Catalytic Asymmetric Addition of Hydrazoic Acid to Ketenes**
Angew. Chem., Int. Ed. **2007**, *46*, 4367–4369.
Dai, X.; Nakai, T.; Romero, J. A. C.; Fu, G. C.
- (150) **Hiyama Reactions of Activated and Unactivated Secondary Alkyl Halides Catalyzed by Nickel/Norephedrine**
Angew. Chem., Int. Ed. **2007**, *46*, 3556–3558.
Strotman, N. A.; Sommer, S.; Fu, G. C.
- (149) **Copper-Catalyzed Asymmetric [4+1] Cycloadditions of Enones with Diazo Compounds to Form Dihydrofurans**
J. Am. Chem. Soc. **2007**, *129*, 1046–1047.
Son, S.; Fu, G. C.
- (148) **Catalytic Asymmetric Synthesis of Tertiary Alkyl Chlorides**
Angew. Chem., Int. Ed. **2007**, *46*, 977–979.
Lee, E. C.; McCauley, K. M.; Fu, G. C.
- (147) **Planar-Chiral Heterocycles as Enantioselective Organocatalysts**
Asymmetric Synthesis, The Essentials; Bräse, S., Christmann, M., Ed.; Wiley–VCH: New York, 2007; pp 186–190.
Fu, G. C.
- (146) **Applications of Planar-Chiral Heterocycles as Ligands in Asymmetric Catalysis**
Acc. Chem. Res. **2006**, *39*, 853–860.
Fu, G. C.
- (145) **Kinetic Resolutions of Indolines by a Non-Enzymatic Acylation Catalyst**
J. Am. Chem. Soc. **2006**, *128*, 14264–14265.
Arp, F. O.; Fu, G. C.
- (144) **The Synthesis of an Enantiopure Planar-Chiral Lewis Acid Complex via Kinetic Resolution and its Application in Stereoselective Additions to Imines**
Tetrahedron (Sympos.) **2006**, *62*, 11343–11349.
Liu, S.-Y.; Lo, M. M.-C.; Fu, G. C.
- (143) **Asymmetric [3+2] Annulations Catalyzed by a Planar-Chiral Derivative of DMAP**
Chem. Commun. **2006**, 2604–2606.
Bappert, E.; Mueller, P.; Fu, G. C.
- (142) **Amino Alcohols as Ligands for Nickel-Catalyzed Suzuki Reactions of Unactivated Alkyl Halides, Including Secondary Alkyl Chlorides, with Arylboronic Acids**
J. Am. Chem. Soc. **2006**, *128*, 5360–5361.
González-Bobes, F.; Fu, G. C.
- (141) **Catalytic Enantioselective O–H Insertion Reactions**
J. Am. Chem. Soc. **2006**, *128*, 4594–4595.
Maier, T. C.; Fu, G. C.
- (140) **Synthesis of Functionalized Cyclopentenes via Catalytic Asymmetric [3+2] Cycloadditions of Allenes with Enones**
Angew. Chem., Int. Ed. **2006**, *45*, 1426–1429.
Wilson, J. E.; Fu, G. C.
- (139) **A Versatile Method for Suzuki Cross-Coupling Reactions of Nitrogen Heterocycles**
Angew. Chem., Int. Ed. **2006**, *45*, 1282–1284.
Kudo, N.; Perseghini, M.; Fu, G. C.

- (138) **Umpolung of Michael Acceptors Catalyzed by *N*-Heterocyclic Carbenes**
J. Am. Chem. Soc. **2006**, *128*, 1472–1473.
Fischer, C.; Smith, S. W.; Powell, D. A.; Fu, G. C.
- (137) **Synthesis, Resolution, and Aldol Reactions of a Planar-Chiral Lewis Acid Complex**
J. Am. Chem. Soc. **2005**, *127*, 15352–15353.
Liu, S.-Y.; Hills, I. D.; Fu, G. C.
- (136) **Catalytic Asymmetric Synthesis of Piperidine Derivatives Through the [4+2] Annulation of Imines with Allenes**
J. Am. Chem. Soc. **2005**, *127*, 12234–12235.
Wurz, R. P.; Fu, G. C.
- (135) **Catalytic Asymmetric Staudinger Reactions to Form β -Lactams: An Unanticipated Dependence of Diastereoselectivity on the Choice of the Nitrogen Substituent**
J. Am. Chem. Soc. **2005**, *127*, 11586–11587.
Lee, E. C.; Hodous, B. L.; Bergin, E.; Shih, C.; Fu, G. C.
- (134) **Kinetic Resolutions of Azomethine Imines via Copper-Catalyzed [3+2] Cycloadditions**
J. Am. Chem. Soc. **2005**, *127*, 11244–11245.
Suarez, A.; Downey, C. W.; Fu, G. C.
- (133) **Catalytic Enantioselective Negishi Reactions of Racemic Secondary Benzylic Halides**
J. Am. Chem. Soc. **2005**, *127*, 10482–10483.
Arp, F. O.; Fu, G. C.
- (132) **Palladium-Catalyzed Cross-Coupling Reactions of Unactivated Alkyl Electrophiles with Organometallic Compounds**
Topics in Organometallic Chemistry: Palladium in Organic Synthesis; Tsuji, J., Ed.; Springer: New York, 2005; pp 85–108.
Netherton, M. R.; Fu, G. C.
- (131) **Catalytic Asymmetric Couplings of Ketenes with Aldehydes to Generate Enol Esters**
Angew. Chem., Int. Ed. **2005**, *44*, 4606–4608.
Schaefer, C.; Fu, G. C.
- (130) **Catalytic Asymmetric Synthesis of Esters from Ketenes**
J. Am. Chem. Soc. **2005**, *127*, 6176–6177.
Wiskur, S. L.; Fu, G. C.
- (129) **Catalytic Enantioselective Construction of All-Carbon Quaternary Stereocenters: Synthetic and Mechanistic Studies of the C-Acylation of Silyl Ketene Acetals**
J. Am. Chem. Soc. **2005**, *127*, 5604–5607.
Mermerian, A. H.; Fu, G. C.
- (128) **Asymmetric Nickel-Catalyzed Negishi Cross-Couplings of Secondary α -Bromo Amides with Organozinc Reagents**
J. Am. Chem. Soc. **2005**, *127*, 4594–4595.
Fischer, C.; Fu, G. C.
- (127) **Nucleophile-Catalyzed Asymmetric Acylations of Silyl Ketene Imines: Application to the Enantioselective Synthesis of Verapamil**
Angew. Chem., Int. Ed. **2005**, *44*, 949–952.
Mermerian, A. H.; Fu, G. C.
- (126) **Recent Advances in Rhodium(I)-Catalyzed Asymmetric Olefin Isomerization and Hydroacylation Reactions**
Modern Rhodium-Catalyzed Transformations; Evans, P. A., Ed.; Wiley-VCH: New York, 2005.
Fu, G. C.
- (125) **Stille Cross-Couplings of Unactivated Secondary Alkyl Halides using Monoorganotin Reagents**
J. Am. Chem. Soc. **2005**, *127*, 510–511.
Powell, D. A.; Maki, T.; Fu, G. C.

- (124) **Nickel-Catalyzed Cross-Couplings of Unactivated Alkyl Halides and Pseudohalides with Organometallic Compounds**
Adv. Syn. Catal. **2004**, *346*, 1525–1532.
Netherton, M. R.; Fu, G. C.
- (123) **Asymmetric Synthesis of β -Lactones by Nucleophile-Catalyzed [2+2] Cycloadditions of Disubstituted Ketenes and Aldehydes**
Angew. Chem., Int. Ed. **2004**, *43*, 6358–6360.
Wilson, J. E.; Fu, G. C.
- (122) **Elucidating Reactivity Differences in Palladium-Catalyzed Coupling Processes: The Chemistry of Palladium Hydrides**
J. Am. Chem. Soc. **2004**, *126*, 13178–13179.
Hills, I. D.; Fu, G. C.
- (121) **Transition Metal-Catalyzed Hydroboration of Olefins**
Transition Metals for Organic Synthesis; Bolm, C., Beller, M., Eds.; VCH: New York; 2004; Chapter 1.5.
Fu, G. C.
- (120) **Heck Reactions of Aryl Chlorides Catalyzed by Palladium/Tri-*Tert*-Butylphosphine: (*E*)-2-Methyl-3-Phenylacrylic Acid Butyl Ester and (*E*)-4-(2-Phenylethenyl)Benzonitrile**
Org. Synth. **2004**, *81*, 63–76.
Littke, A. F.; Fu, G. C.
- (119) **Asymmetric Catalysis with "Planar-Chiral" Derivatives of DMAP**
Acc. Chem. Res. **2004**, *37*, 542–547.
Fu, G. C.
- (118) **A Straightforward and Mild Synthesis of Functionalized 3-Alkynoates**
Angew. Chem., Int. Ed. **2004**, *43*, 3580–3582.
Suarez, A.; Fu, G. C.
- (117) **Nickel-Catalyzed Cross-Couplings of Organosilicon Reagents with Unactivated Secondary Alkyl Bromides**
J. Am. Chem. Soc. **2004**, *126*, 7788–7789.
Powell, D. A.; Fu, G. C.
- (116) **From the Design of a Chiral Lewis Acid Catalyst to Metal-Catalyzed Coupling Reactions**
J. Org. Chem. **2004**, *69*, 3245–3249.
Fu, G. C.
- (115) **Suzuki Cross-Couplings of Unactivated Secondary Alkyl Bromides and Iodides**
J. Am. Chem. Soc. **2004**, *126*, 1340–1341.
Zhou, J.; Fu, G. C.
- (114) **Cross-Couplings of Alkyl Electrophiles Under "Ligandless" Conditions: Negishi Reactions of Organozirconium Reagents**
J. Am. Chem. Soc. **2004**, *126*, 82–83.
Wiskur, S. L.; Korte, A.; Fu, G. C.
- (113) **Cross-Couplings of Unactivated Secondary Alkyl Halides: Room-Temperature Nickel-Catalyzed Negishi Reactions of Alkyl Bromides and Iodides**
J. Am. Chem. Soc. **2003**, *125*, 14726–14727.
Zhou, J.; Fu, G. C.
- (112) **Toward an Improved Understanding of the Unusual Reactivity of Pd(0)/Trialkylphosphine Catalysts in Cross-Couplings of Alkyl Electrophiles: Quantifying the Factors that Determine the Rate of Oxidative Addition**
Angew. Chem., Int. Ed. **2003**, *42*, 5749–5752.
Hills, I. D.; Netherton, M. R.; Fu, G. C.

- (111) **The First Applications of Carbene Ligands in Cross-Couplings of Alkyl Electrophiles: Sonogashira Reactions of Unactivated Alkyl Bromides and Iodides**
J. Am. Chem. Soc. **2003**, *125*, 13642–13643.
Eckhardt, M.; Fu, G. C.
- (110) **Ligands for Palladium-Catalyzed Cross-Couplings of Alkyl Halides: Use of an Alkyldiaminophosphine Expands the Scope of the Stille Reaction**
Angew. Chem., Int. Ed. **2003**, *42*, 5079–5082.
Tang, H.; Menzel, K.; Fu, G. C.
- (109) **Palladium-Catalyzed Negishi Cross-Coupling Reactions of Unactivated Alkyl Iodides, Bromides, Chlorides, and Tosylates**
J. Am. Chem. Soc. **2003**, *125*, 12527–12530.
Zhou, J.; Fu, G. C.
- (108) **A New Copper-Catalyzed [3+2] Cycloaddition: Enantioselective Coupling of Terminal Alkynes with Azomethine Imines to Generate Five-Membered Nitrogen Heterocycles**
J. Am. Chem. Soc. **2003**, *125*, 10778–10779.
Shintani, R.; Fu, G. C.
- (107) **Catalytic Enantioselective Synthesis of β -Lactams: Intramolecular Kinugasa Reactions and Interception of an Intermediate in the Reaction Cascade**
Angew. Chem., Int. Ed. **2003**, *42*, 4082–4085.
Shintani, R.; Fu, G. C.
- (106) **Catalytic Enantioselective Synthesis of Oxindoles and Benzofuranones that Bear a Quaternary Stereocenter**
Angew. Chem., Int. Ed. **2003**, *42*, 3921–3924.
Hills, I. D.; Fu, G. C.
- (105) **Parallel Kinetic Resolution of 4-Alkynals Catalyzed by Rh(I)/Tol-BINAP: Synthesis of Enantioenriched Cyclobutanones and Cyclopentenones**
J. Am. Chem. Soc. **2003**, *125*, 8078–8079.
Tanaka, K.; Fu, G. C.
- (104) **Room-Temperature Hiyama Cross-Couplings of Arylsilanes with Alkyl Bromides and Iodides**
J. Am. Chem. Soc. **2003**, *125*, 5616–5617.
Lee, J.-Y.; Fu, G. C.
- (103) **Catalytic Enantioselective Synthesis of Quaternary Stereocenters via Intermolecular C-Acylation of Silyl Ketene Acetals: Dual Activation of the Electrophile and the Nucleophile**
J. Am. Chem. Soc. **2003**, *125*, 4050–4051.
Mermerian, A. H.; Fu, G. C.
- (102) **Room-Temperature Stille Cross-Couplings of Alkenyltin Reagents with an Array of Functionalized Alkyl Bromides that Possess β Hydrogens**
J. Am. Chem. Soc. **2003**, *125*, 3718–3719.
Menzel, K.; Fu, G. C.
- (101) **Boronic Acids: New Coupling Partners in Room-Temperature Suzuki Reactions of Alkyl Bromides. Crystallographic Characterization of an Oxidative-Addition Adduct Generated Under Remarkably Mild Conditions**
J. Am. Chem. Soc. **2002**, *124*, 13662–13663.
Kirchhoff, J. H.; Netherton, M. R.; Hills, I. D.; Fu, G. C.
- (100) **Copper-Catalyzed Enantioselective Conjugate Addition of Diethylzinc to Acyclic Enones in the Presence of Planar-Chiral Phosphaferrocene-Oxazoline Ligands**
Org. Lett. **2002**, *4*, 3699–3702.
Shintani, R.; Fu, G. C.

- (99) **Application of a New Family of P,N-Ligands to the Highly Enantioselective Hydrosilylation of Aryl Alkyl and Dialkyl Ketones**
Angew. Chem., Int. Ed. **2002**, *41*, 3892–3894.
Tao, B.; Fu, G. C.
- (98) **Palladium-Catalyzed Coupling Reactions of Aryl Chlorides**
Angew. Chem., Int. Ed. **2002**, *41*, 4176–4211.
Littke, A. F.; Fu, G. C.
- (97) **Suzuki Cross-Couplings of Alkyl Tosylates that Possess β Hydrogen Atoms: Synthetic and Mechanistic Studies**
Angew. Chem., Int. Ed. **2002**, *41*, 3910–3912.
Netherton, M. R.; Fu, G. C.
- (96) **The First General Method for the Synthesis of Transition-Metal π Complexes of an Electronically Diverse Family of 1,2-Azaborolyls**
Organometallics **2002**, *21*, 4323–4325.
Liu, S.-Y.; Hills, I. D.; Fu, G. C.
- (95) **Enantioselective Synthesis of Cyclopentenones via Rhodium-Catalyzed Kinetic Resolution and Desymmetrization of 4-Alkynals**
J. Am. Chem. Soc. **2002**, *124*, 10296–10297.
Tanaka, K.; Fu, G. C.
- (94) **Enantioselective Addition of Amines to Ketenes Catalyzed by a Planar-Chiral Derivative of PPY: Possible Intervention of Chiral Brønsted-Acid Catalysis**
J. Am. Chem. Soc. **2002**, *124*, 10006–10007.
Hodous, B. L.; Fu, G. C.
- (93) **A Method for Palladium-Catalyzed Cross-Couplings of Simple Alkyl Chlorides: Suzuki Reactions Catalyzed by $[\text{Pd}_2(\text{dba})_3]/\text{PCy}_3$**
Angew. Chem., Int. Ed. **2002**, *41*, 1945–1947.
Kirchhoff, J. H.; Dai, C.; Fu, G. C.
- (92) **$\text{Pd}/\text{P}(t\text{-Bu})_3$: A Mild and General Catalyst for Stille Reactions of Aryl Chlorides and Aryl Bromides**
J. Am. Chem. Soc. **2002**, *124*, 6343–6348.
Littke, A. F.; Schwarz, L.; Fu, G. C.
- (91) **A Novel Rhodium-Catalyzed Reduction-Oxidation Process: Reaction of 4-Alkynals with Phenol to Provide *cis*-4-Alkenoates**
Angew. Chem., Int. Ed. **2002**, *41*, 1607–1609.
Tanaka, K.; Fu, G. C.
- (90) **$\text{Cu}(\text{I})/\text{Bis}(\text{azaferrocene})$ -Catalyzed Enantioselective Synthesis of β -Lactams via Couplings of Alkynes with Nitrones**
J. Am. Chem. Soc. **2002**, *124*, 4572–4573.
Lo, M. M.-C.; Fu, G. C.
- (89) **A Unique Rhodium-Catalyzed Rearrangement Process: Isomerization of an Alkyne to a 1,3-Diene with Concomitant Migration of a Formyl Group. An Expedient Route to Dienals from Readily Available 4-Alkynals**
Chem. Commun. **2002**, 684–685.
Tanaka, K.; Fu, G. C.
- (88) **Highly Enantioselective Desymmetrization of Anhydrides by Carbon Nucleophiles: Reactions of Grignard Reagents in the Presence of (–)-Sparteine**
Angew. Chem., Int. Ed. **2002**, *41*, 1057–1059.
Shintani, R.; Fu, G. C.
- (87) **Rhodium-Catalyzed Synthesis of Cyclohexenones via a Novel [4+2] Annulation**
Org. Lett. **2002**, *4*, 933–935.
Tanaka, K.; Fu, G. C.

- (86) **Enantioselective Staudinger Synthesis of β -Lactams Catalyzed by a Planar-Chiral Nucleophile**
J. Am. Chem. Soc. **2002**, *124*, 1578–1579.
Hodous, B. L.; Fu, G. C.
- (85) **New Applications of Organometallic Catalysts in Organic Chemistry**
Pure Appl. Chem. **2002**, *74*, 33–36.
Fu, G. C.
- (84) **1,2-Azaborolyls, Isoelectronic Analogues of the Ubiquitous Cyclopentadienyl Ligand: Synthesis of B-Heteroatom-Substituted 1,2-Azaborolyl Complexes and an Assessment of Their Electronic Features**
Angew. Chem., Int. Ed. **2002**, *41*, 174–176.
Liu, S.-Y.; Lo, M. M.-C.; Fu, G. C.
- (83) **Air-Stable Trialkylphosphonium Salts: Simple, Practical, and Versatile Replacements for Air-Sensitive Trialkylphosphines. Applications in Stoichiometric and Catalytic Processes**
Org. Lett. **2001**, *3*, 4295–4298.
Netherton, M. R.; Fu, G. C.
- (82) **A Versatile New Catalyst for the Enantioselective Isomerization of Allylic Alcohols to Aldehydes: Scope and Mechanistic Studies**
J. Org. Chem. **2001**, *66*, 8177–8186.
Tanaka, K.; Fu, G. C.
- (81) **A Surprisingly Mild and Versatile Method for Palladium-Catalyzed Suzuki Cross-Couplings of Aryl Chlorides in the Presence of a Triarylphosphine**
Chem. Commun. **2001**, 2408–2409.
Liu, S.-Y.; Choi, M. J.; Fu, G. C.
- (80) **A Versatile New Method for the Synthesis of Cyclopentenones via an Unusual Rhodium-Catalyzed Intramolecular *trans* Hydroacylation of an Alkyne**
J. Am. Chem. Soc. **2001**, *123*, 11492–11493.
Tanaka, K.; Fu, G. C.
- (79) **Room-Temperature Alkyl-Alkyl Suzuki Cross-Coupling of Alkyl Bromides that Possess β Hydrogens**
J. Am. Chem. Soc. **2001**, *123*, 10099–10100.
Netherton, M. R.; Dai, C.; Neuschütz, K.; Fu, G. C.
- (78) **Applications of "Planar-Chiral" Heterocycles in Asymmetric Catalysis**
Pure Appl. Chem. **2001**, *73*, 1113–1116.
Fu, G. C.
- (77) **The Chemistry of Borabenzenes (1986-2000)**
Adv. Organomet. Chem. **2001**, *47*, 101–119.
Fu, G. C.
- (76) **A Versatile Catalyst for Heck Reactions of Aryl Chlorides and Aryl Bromides Under Mild Conditions**
J. Am. Chem. Soc. **2001**, *123*, 6989–7000.
Littke, A. F.; Fu, G. C.
- (75) **Synthesis, Structure, and Reactivity of C_2 -Symmetric Bis(phospholyl)zirconium and Bis(phospholyl)hafnium Complexes**
Organometallics **2001**, *20*, 3453–3458.
Bellemin-Laponnaz, S.; Lo, M. M.-C.; Peterson, T. H.; Allen, J. M.; Fu, G. C.
- (74) **Asymmetric Catalysis with "Planar-Chiral" Heterocycles**
Pure Appl. Chem. **2001**, *73*, 347–349.
Fu, G. C.

- (73) **Applications of Planar-Chiral Heterocycles in Enantioselective Catalysis: Cu(I)/Bisazaferrocene-Catalyzed Asymmetric Ring Expansion of Oxetanes to Tetrahydrofurans**
Tetrahedron (Spec. Issue) **2001**, *57*, 2621–2634.
Lo, M. M.-C.; Fu, G. C.
- (72) **The First General Method for Palladium-Catalyzed Negishi Cross-Coupling of Aryl and Vinyl Chlorides: Use of Commercially Available Pd(P(*t*-Bu)₃)₂ as a Catalyst**
J. Am. Chem. Soc. **2001**, *123*, 2719–2724.
Dai, C.; Fu, G. C.
- (71) **Planar-Chiral Pyridine *N*-Oxides, a New Family of Asymmetric Catalysts: Exploiting an η^5 -C₅Ar₅ Ligand to Achieve High Enantioselectivity**
J. Am. Chem. Soc. **2001**, *123*, 353–354.
Tao, B.; Lo, M. M.-C.; Fu, G. C.
- (70) **Kinetic Resolution of Amines by a Non-Enzymatic Acylation Catalyst**
Angew. Chem., Int. Ed. **2001**, *40*, 234–236.
Arai, S.; Bellemin-Laponnaz, S.; Fu, G. C.
- (69) **Bu₃SnH-Catalyzed Barton-McCombie Deoxygenation Of Alcohols: 3-Deoxy-1,2:5,6-bis-*O*-(1-methylethylidene)- α -D-ribo-hexofuranose**
Org. Synth. **2000**, *78*, 239–248.
Tormo, J.; Fu, G. C.
- (68) **Synthesis and Application of Planar-Chiral Phosphaferrocene–Oxazolines, a New Class of P,N–Ligands**
Org. Lett. **2000**, *2*, 3695–3697.
Shintani, R.; Lo, M. M.-C.; Fu, G. C.
- (67) **Enantioselective Isomerization of Allylic Alcohols Catalyzed by a Rhodium/Phosphaferrocene Complex**
J. Am. Chem. Soc. **2000**, *122*, 9870–9871.
Tanaka, K.; Qiao, S.; Tobisu, M.; Lo, M. M.-C.; Fu, G. C.
- (66) **Enantioselective Nucleophilic Catalysis with "Planar-Chiral" Heterocycles**
Acc. Chem. Res. **2000**, *33*, 412–420.
Fu, G. C.
- (65) **Pd(PhCN)₂Cl₂/P(*t*-Bu)₃: A Versatile Catalyst for Sonogashira Reactions of Aryl Bromides at Room Temperature**
Org. Lett. **2000**, *2*, 1729–1731.
Hundertmark, T.; Littke, A. F.; Buchwald, S. L.; Fu, G. C.
- (64) **The Kinetic Resolution of Allylic Alcohols by a Non-Enzymatic Acylation Catalyst; Application to Natural Product Synthesis**
Chem. Commun. **2000**, 1009–1010.
Bellemin-Laponnaz, S.; Tweddell, J.; Ruble, J. C.; Breitling, F. M.; Fu, G. C.
- (63) **The First Synthesis and Resolution of a Planar-Chiral Tetrahydroindolyl Complex of Iron: Electronic Tuning of Reactivity and Enantioselective Nucleophilic Catalysis**
Chirality (Spec. Issue) **2000**, *12*, 318–324.
Suginome, M.; Fu, G. C.
- (62) **Versatile Catalysts for the Suzuki Cross-Coupling of Arylboronic Acids with Aryl and Vinyl Halides and Triflates Under Mild Conditions**
J. Am. Chem. Soc. **2000**, *122*, 4020–4028.
Littke, A. F.; Dai, C.; Fu, G. C.
- (61) **Pinacol Coupling**
Modern Carbonyl Chemistry; Otera, J., Ed.; VCH: New York, 2000.
Fu, G. C.

- (60) **Synthesis, Resolution, and Crystallographic Characterization of a New, C_2 -Symmetric, Planar-Chiral Bipyridine Ligand. Application to the Catalytic Enantioselective Cyclopropanation of Olefins**
Chem. Commun. **2000**, 377–378.
Rios, R.; Liang, J.; Lo, M. M.-C.; Fu, G. C.
- (59) **From Planarity to Chirality**
Chem. Innovation **2000**, *30*, 3–5.
Fu, G. C.
- (58) **A New Benchmark for the Non-Enzymatic Enantioselective Acylation of Amines. Use of a Planar-Chiral Derivative of 4-Pyrrolidinopyridine as the Acylating Agent**
Chem. Commun. **2000**, 119–120.
Ie, Y.; Fu, G. C.
- (57) **The Development of a New Catalytic Process: Bu_3SnH -Catalyzed Reductive Cyclization of Enals and Enones**
Tetrahedron (Spec. Issue) **1999**, *55*, 8815–8832.
Hays, D. S.; Fu, G. C.
- (56) **The First General Method for Stille Cross-Couplings of Aryl Chlorides**
Angew. Chem., Int. Ed. **1999**, *38*, 2411–2413.
Littke, A. F.; Fu, G. C.
- (55) **Non-Enzymatic Kinetic Resolution of Propargylic Alcohols by a Planar-Chiral DMAP Derivative; Crystallographic Characterization of the Acylated Catalyst**
J. Am. Chem. Soc. **1999**, *121*, 5091–5092.
Tao, B.; Ruble, J. C.; Hoic, D. A.; Fu, G. C.
- (54) **Enantioselective Addition of Alcohols to Ketenes Catalyzed by a Planar-Chiral Azaferrocene: Catalytic Asymmetric Synthesis of Arylpropionic Acids**
J. Am. Chem. Soc. **1999**, *121*, 2637–2638.
Hodous, B. L.; Ruble, J. C.; Fu, G. C.
- (53) **Heck Reactions in the Presence of $P(t-Bu)_3$: Expanded Scope and Milder Reaction Conditions for the Coupling of Aryl Chlorides**
J. Org. Chem. **1999**, *64*, 10–11.
Littke, A. F.; Fu, G. C.
- (52) **A Convenient and General Method for Palladium-Catalyzed Suzuki Cross-Couplings of Aryl Chlorides and Arylboronic Acids**
Angew. Chem., Int. Ed. **1998**, *37*, 3387–3388.
Littke, A. F.; Fu, G. C.
- (51) **Enantioselective Construction of Quaternary Stereocenters: Rearrangements of *O*-Acylated Azlactones Catalyzed by a Planar-Chiral Derivative of 4-(Pyrrolidino)pyridine**
J. Am. Chem. Soc. **1998**, *120*, 11532–11533.
Ruble, J. C.; Fu, G. C.
- (50) **A New Class of Planar-Chiral Ligands: The Synthesis of a C_2 -Symmetric Bisazaferrocene and its Application in the Enantioselective $Cu(I)$ -Catalyzed Cyclopropanation of Olefins**
J. Am. Chem. Soc. **1998**, *120*, 10270–10271.
Lo, M. M.-C.; Fu, G. C.
- (49) **Metal-Catalyzed Hydroboration Reactions**
Transition Metals for Fine Chemicals and Organic Synthesis; Bolm, C., Beller, M., Eds.; VCH: New York, 1998.
Fu, G. C.
- (48) **Bu_3SnH -Mediated Pinacol Coupling of 1,5- and 1,6-Dicarbonyl Compounds: Synthetic and Mechanistic Studies**
J. Org. Chem. **1998**, *63*, 6375–6381.
Hays, D. S.; Fu, G. C.

- (47) **Bu₃SnH-Catalyzed Reduction of Nitroalkanes to Alkanes**
J. Org. Chem. **1998**, *63*, 5296–5297.
Tormo, J.; Hays, D. S.; Fu, G. C.
- (46) **Nucleophilic Catalysis with π -Bound Nitrogen Heterocycles: Synthesis of the First Ruthenium Catalysts and Comparison of the Reactivity and the Enantioselectivity of Ruthenium and Iron Complexes**
J. Am. Chem. Soc. **1998**, *120*, 7479–7483.
Garrett, C. E.; Lo, M. M.-C.; Fu, G. C.
- (45) **The First Application of a Planar-Chiral Phosphorus Heterocycle in Asymmetric Catalysis: Enantioselective Hydrogenation of Dehydroamino Acids**
J. Org. Chem. **1998**, *63*, 4168–4169.
Qiao, S.; Fu, G. C.
- (44) **Dynamic Kinetic Resolutions Catalyzed by a Planar-Chiral Derivative of DMAP: Enantioselective Synthesis of Protected α -Amino Acids from Racemic Azlactones**
J. Org. Chem. **1998**, *63*, 3154–3155.
Liang, J.; Ruble, J. C.; Fu, G. C.
- (43) **The Development of Bu₃SnH-Catalyzed Processes: Efficient Reduction of Azides to Amines**
J. Org. Chem. **1998**, *63*, 2796–2797.
Hays, D. S.; Fu, G. C.
- (42) **Kinetic Resolution of Aryl Alkyl Carbinols Catalyzed by a Planar-Chiral Derivative of DMAP: A New Benchmark for Non-Enzymatic Acylation**
J. Org. Chem. **1998**, *63*, 2794–2795.
Ruble, J. C.; Tweddell, J.; Fu, G. C.
- (41) **Exploiting η^5 - to η^3 -Indenyl Ring Slippage to Access a Directed Reaction: Ether-Directed, Rhodium-Catalyzed Olefin Hydroboration**
J. Org. Chem. **1998**, *63*, 1370–1371.
Garrett, C. E.; Fu, G. C.
- (40) **Synthesis, Resolution, and Crystallographic Characterization of a C₂-Symmetric Diphosphaferrocene**
Organometallics **1998**, *17*, 773–774.
Qiao, S.; Hoic, D. A.; Fu, G. C.
- (39) **Catalytic Asymmetric Addition of ZnPh₂ to Ketones: Enantioselective Formation of Quaternary Stereocenters**
J. Am. Chem. Soc. **1998**, *120*, 445–446.
Dosa, P. I.; Fu, G. C.
- (38) **Diastereoselective Synthesis of β -Aminoalcohols via Bu₃SnH-Mediated Reductive Cyclization of Carbonyl-Oxime Ethers**
J. Org. Chem. **1998**, *63*, 201–202.
Tormo, J.; Hays, D. S.; Fu, G. C.
- (37) **A Mild, Convenient, and Inexpensive Method for Converting Imines into Amines: Tin-Catalyzed Reduction with Polymethylhydrosiloxane (PMHS)**
Tetrahedron (Sympos.) **1997**, *53*, 16349–16354.
Lopez, R. M.; Fu, G. C.
- (36) **The First Synthesis and Structural Characterization of an Enantiomerically Pure Planar-Chiral Lewis Acid Complex**
J. Org. Chem. **1997**, *62*, 8286–8287.
Tweddell, J.; Hoic, D. A.; Fu, G. C.
- (35) **A New Method for Generating Sn-H Bonds: Reactions of Tin Amides with Silicon Hydrides**
J. Org. Chem. **1997**, *62*, 7070–7071.
Hays, D. S.; Fu, G. C.

- (34) **Direct Crystallographic Comparison of P-B and N-B π -Bonding: Structural Studies of Diphenylphosphido- and Diphenylamidoboratabenzene**
J. Am. Chem. Soc. **1997**, *119*, 7155–7156.
Hoic, D. A.; DiMare, M.; Fu, G. C.
- (33) **Bu₃SnH-Catalyzed Barton-McCombie Deoxygenation of Alcohols**
J. Am. Chem. Soc. **1997**, *119*, 6949–6950.
Lopez, R. M.; Hays, D. S.; Fu, G. C.
- (32) **π -Bound Phosphorus Heterocycles as Catalysts: Ring Opening of Epoxides with TMSCl in the Presence of a Phosphaferrocene**
J. Org. Chem. **1997**, *62*, 4534–4535.
Garrett, C. E.; Fu, G. C.
- (31) **Synthesis and Structure of Borabenzene-(4-Phenylpyridine), a Heterocyclic Analogue of *p*-Terphenyl**
Organometallics **1997**, *16*, 1501–1502.
Qiao, S.; Hoic, D. A.; Fu, G. C.
- (30) **Effective Kinetic Resolution of Secondary Alcohols with a Planar-Chiral Analogue of DMAP. Use of the Fe(C₅Ph₅) Group in Asymmetric Catalysis**
J. Am. Chem. Soc. **1997**, *119*, 1492–1493.
Ruble, J. C.; Latham, H. A.; Fu, G. C.
- (29) **Planar-Chiral Heterocycles as Ligands in Metal-Catalyzed Processes: Enantioselective Addition of Organozinc Reagents to Aldehydes**
J. Org. Chem. **1997**, *62*, 444–445.
Dosa, P. I.; Ruble, J. C.; Fu, G. C.
- (28) **Defining the Conformation of Lewis Acid-Lewis Base Complexes: Crystallographic Evidence for Simultaneous σ and π Donation by a Carbonyl Group to a Divalent Boron Lewis Acid**
Angew. Chem., Int. Ed. Engl. **1997**, *36*, 267–269.
Amendola, M. C.; Stockman, K. E.; Hoic, D. A.; Davis, W. M.; Fu, G. C.
- (27) **Chiral π -Complexes of Heterocycles with Transition Metals: A Versatile New Family of Nucleophilic Catalysts**
J. Org. Chem. **1996**, *61*, 7230–7231.
Ruble, J. C.; Fu, G. C.
- (26) **Organotin Hydride-Catalyzed Conjugate Reduction of α,β -Unsaturated Ketones**
J. Org. Chem. **1996**, *61*, 6751–6752.
Hays, D. S.; Scholl, M.; Fu, G. C.
- (25) **Diphenylphosphidoboratabenzene: An Anionic Analogue of Triphenylphosphine**
J. Am. Chem. Soc. **1996**, *118*, 8176–8177.
Hoic, D. A.; Davis, W. M.; Fu, G. C.
- (24) **Nucleophilic Aromatic Substitution Reactions of Borabenzene-Trimethylphosphine: A Versatile Route to 1-Substituted Boratabenzenes**
J. Am. Chem. Soc. **1996**, *118*, 6329–6330.
Qiao, S.; Hoic, D. A.; Fu, G. C.
- (23) **Hydroboration of Olefins with Catecholborane at Room Temperature in the Presence of *N,N*-Dimethylacetamide**
J. Org. Chem. **1996**, *61*, 3224–3225.
Garrett, C. E.; Fu, G. C.
- (22) **Chemistry of Borabenzene: An Efficient and General Synthesis of New Neutral Borabenzene-Ligand Complexes**
Organometallics **1996**, *15*, 1315–1318.
Hoic, D. A.; Wolf, J. R.; Davis, W. M.; Fu, G. C.

- (21) **Organotin Hydride Catalyzed Carbon-Carbon Bond Formation: Radical-Mediated Reductive Cyclization of Enals and Enones**
J. Org. Chem. **1996**, *61*, 4–5.
Hays, D. S.; Fu, G. C.
- (20) **Ring-Closing Metathesis and Related Processes in Organic Synthesis**
Acc. Chem. Res. **1995**, *28*, 446–452.
Grubbs, R. H.; Miller, S. J.; Fu, G. C.
- (19) **Convenient and Efficient Conversion of Aldehydes to Acylated Cyanohydrins Using Tributyltin Cyanide as a Catalyst**
J. Org. Chem. **1995**, *60*, 6229–6231.
Scholl, M.; Lim, C.-K.; Fu, G. C.
- (18) **A Boron Analogue of Benzene: Synthesis, Structure, and Reactivity of 1-*H*-Boratabenzene**
J. Am. Chem. Soc. **1995**, *117*, 8480–8481.
Hoic, D. A.; Davis, W. M.; Fu, G. C.
- (17) **Metal Hydride-Mediated Intramolecular Pinacol Coupling of Dialdehydes and Ketoaldehydes**
J. Am. Chem. Soc. **1995**, *117*, 7283–7284.
Hays, D. S.; Fu, G. C.
- (16) **Hydroxyl-Directed, Stereoselective Olefination of Ketones by Transition Metal Alkylidenes**
J. Am. Chem. Soc. **1995**, *117*, 2355–2356.
Fujimura, O.; Fu, G. C.; Rothmund, P. W. K.; Grubbs, R. H.
- (15) **Metal-Catalyzed Hydroboration Reactions**
Advances in Catalytic Processes; Doyle, M. P., Ed.; JAI: Greenwich, CT, 1995; Vol. 1, 95–121.
Fu, G. C.; Evans, D. A.; Muci, A. R.
- (14) **Tributyltin Cyanide Catalyzed Addition of Triethylsilyl Cyanide to Aldehydes**
J. Org. Chem. **1994**, *59*, 7178–7179.
Scholl, M.; Fu, G. C.
- (13) **The Synthesis of Cyclic Enol Ethers via Molybdenum Alkylidene-Catalyzed Ring-Closing Metathesis**
J. Org. Chem. **1994**, *59*, 4029–4031.
Fujimura, O.; Fu, G. C.; Grubbs, R. H.
- (12) **Catalytic Ring-Closing Metathesis of Functionalized Dienes by a Ruthenium Carbene Complex**
J. Am. Chem. Soc. **1993**, *115*, 9856–9857.
Fu, G. C.; Nguyen, S. T.; Grubbs, R. H.
- (11) **The Synthesis of Cycloalkenes via Alkylidene-Mediated Olefin Metathesis and Carbonyl Olefination**
J. Am. Chem. Soc. **1993**, *115*, 3800–3801.
Fu, G. C.; Grubbs, R. H.
- (10) **Substrate-Directable Chemical Reactions**
Chem. Rev. **1993**, *93*, 1307–1370.
Hoveyda, A. H.; Evans, D. A.; Fu, G. C.
- (9) **Synthesis of Nitrogen Heterocycles via Catalytic Ring-Closing Metathesis of Dienes**
J. Am. Chem. Soc. **1992**, *114*, 7324–7325.
Fu, G. C.; Grubbs, R. H.
- (8) **Mechanistic Study of the Rhodium(I)-Catalyzed Hydroboration Reaction**
J. Am. Chem. Soc. **1992**, *114*, 6679–6685.
Evans, D. A.; Fu, G. C.; Anderson, B. A.
- (7) **Rhodium(I)- and Iridium(I)-Catalyzed Hydroboration Reactions: Scope and Synthetic Applications**
J. Am. Chem. Soc. **1992**, *114*, 6671–6679.
Evans, D. A.; Fu, G. C.; Hoveyda, A. H.

- (6) **The Application of Catalytic Ring-Closing Olefin Metathesis to the Synthesis of Unsaturated Oxygen Heterocycles**
J. Am. Chem. Soc. **1992**, *114*, 5426–5427.
Fu, G. C.; Grubbs, R. H.
- (5) **Amide-Directed, Iridium-Catalyzed Hydroboration of Olefins: Documentation of Regio- and Stereochemical Control in Cyclic and Acyclic Systems**
J. Am. Chem. Soc. **1991**, *113*, 4042–4043.
Evans, D. A.; Fu, G. C.
- (4) **Conjugate Reduction of α,β -Unsaturated Carbonyl Compounds by Catecholborane**
J. Org. Chem. **1990**, *55*, 5678–5680.
Evans, D. A.; Fu, G. C.
- (3) **The Rhodium-Catalyzed Hydroboration of Olefins: A Mechanistic Investigation**
J. Org. Chem. **1990**, *55*, 2280–2282.
Evans, D. A.; Fu, G. C.
- (2) **Rhodium(I)-Catalyzed Hydroboration of Olefins: The Documentation of Regio- and Stereochemical Control in Cyclic and Acyclic Systems**
J. Am. Chem. Soc. **1988**, *110*, 6917–6918.
Evans, D. A.; Fu, G. C.; Hoveyda, A. H.
- (1) **Asymmetric Michael Reactions of 3,5-Dihydro-4*H*-dinaphth[2,1-*c*:1',2'-*e*]azepine with Methyl Crotonate**
J. Org. Chem. **1986**, *51*, 2820–2822.
Hawkins, J. M.; Fu, G. C.