CURRICULUM VITAE

Alberto Fraile Carrasco

Office:
Organic Chemistry Department (C-I)
Sciences Faculty
Universidad Autónoma de Madrid
28049 Cantoblanco, Madrid, Spain
Phone: 34 914973877
Fax: 34 914973966
E-mail: alberto.fraile@uam.es

Home:
C/ San Juan de la Cruz, 1, Portal 4, 2ªA
28229 Villanueva del Pardillo, Madrid, Spain
Phone: 34 918314045
Mobil: 670705228
E-mail: albertofrailecarrasco@gmail.com

PERSONAL INFORMATION

First and Family name	Alberto Fraile Carrasco		
Social Security, Passport, ID number	52124312X	Date of Birth	May 10th, 1971
Researcher numbers	Researcher ID	B-2161-2013	
	Orcid code	0000-0002-7510-8521	
	Scopus ID	16230060700	

Current position

Name of University/Institution	Universidad Autónoma de Madrid			
Department	Organic Chemistry / Sciences Faculty			
Address and Country	Calle Francisco Tomás y Valiente, 7, 28049-Madrid			
Phone number	914973877	E-mail	alberto.fraile@uam.es	
Current position	Associate Professor		From	29/11/2013
Espec. cód. UNESCO	2306 – Organic Chemistry			
Palabras clave	Catalysis, asymmetric synthesis, organocatalysis, photocatalysis			

- **JCR articles, h Index, thesis supervised…**

  44 publications (8 as corresponding author and 31 journals in the Q1, *Nature Communications, Angewandte Chemie International Edition*, *ACS Catalysis*, *Chemical Science*, *Chemistry-A European Journal*, *Organic Letters*, *Journal of Organic Chemistry*, *Advanced Synthesis and Catalysis, Chemical Communication*); h index = 18; total citations = 686 (68 per year, 2014-2018); director of 3 PhD thesis (one presented and two on going), director of 7 master thesis and supervisor of 11 undergraduate students; Six-year research periods (sexenios; last: 2012-2017) = 3; Five-year periods (quinquenios, last: 2013-2017) = 3.

- **CV SUMMARY:**

Alberto Fraile received his B.Sc. in Chemistry from the Universidad Autónoma of Madrid (Spain) (1989-1994). Then, he joined the group of Prof. Jose Luis García Ruano at the same University, and obtained his M.Sc. in 1997 with an UAM Master's fellowship. In 2003, he finished his Ph.D. thesis focused on the studies of asymmetric [3+2] cycloadditions of sulfinilfuranones and several dipoles with the highest qualification ("Summa Cum Laude"). During his PhD. participated in the development of the research project: "Synthesis of heterocyclic compounds" supported by Janssen-Cilag (1999-2001). Between 2002 and 2008 he was the responsible researcher in the development of the research project: "Studies on improving intermediate synthesis of several drugs" supported by Sanofi-Aventis. In 2011, he carried out a post-doctoral stay in Denmark (one year) in the group of Prof. Karl Anker Jørgensen, with a research contract from Aarhus University, working in the area of organocatalysis. During this stay, he developed and took part in different projects aimed to study different organocatalytic processes that led to tree papers (1 Angew. Chem. Int. Ed. and 2 Chem. Eur. J.). In 2012, he went back to Organic Chemistry Department at the Universidad Autónoma de Madrid where has been working on some topics of sulfur chemistry and, additionally, has opened new research lines concerning organocatalysis and photocatalysis, mainly related to the development of new reactions and catalysts.

Since 2000, Alberto Fraile has collaborated in the teaching of Organic Chemistry Department at the Universidad Autónoma de Madrid as Assistant professor (2000-2012) and currently as Associate professor.

In 2013, He was qualified as "Profesor Titular" by the ANECA (Spanish Government).

- **RESEARCH AREAS**

- 1,3-Dipolar cycloadditions to activated cyclic and acyclic vinylsulfoxides
- Development of new organocatalytic and photocatalytic processes.

- **EDUCATION:**

- Post-Doctoral Stay. Center for Catalysis, Aarhus University, Aarhus (Denmark). Period: 01/04/2011 to 31/03/2012. Supervisor: Karl Anker Jørgensen.

- Ph. Degree in Chemistry (Organic Chemistry). Universidad Autónoma de Madrid. 23-June-2003.
  Research Supervisors: Prof. María del Rosario Martín Ramos and Prof. José Luis García Ruano.
  Dissertation: *"Role of the sulfinyl group in 1,3-dipolar cycloadditions to 3-*p*-tolylsulfinyl-2(5*H*)-ones"*.
  Grade: Highest mark with distinction (SUMMA CUM LAUDE).

- M. Sc. in Organic Chemistry. Universidad Autónoma de Madrid. 27-June-1997.
  Research Supervisors: Prof. María del Rosario Martín Ramos and Prof. José Luis García Ruano.
  Dissertation: *"1,3-Dipolar cycloadditions to* tert*-butyl (*E*)-(*S_S*)-4,4-diethoxy-2-*p*-toylsulfinyl-2-butenoate and (*S_S*)-5-ethoxy-3-*p*-tolylsulfinylfuran-2(5*H*)-ones"*.
  Grade: Highest mark with distinction.

- B. Sc. in Chemistry (Organic Chemistry). Universidad Autónoma de Madrid. June 1994.

- Teaching Training Course at Universidad Complutense de Madrid (academic year 1996/1997).

- **RESEARCH EXPERIENCE:**

  - ***Research grants:***

    - ✓ October 1994-September 1996: Universidad Autónoma de Madrid fellowship. (predoctoral).

    - ✓ January 1997-January 2000: Fundación Universidad Empresa fellowship (University-Enterprise Foundation) (predoctoral).

  - ***Publications:***

    1. García Ruano, J. L.; Fraile, A. and Martín, M. R. "**(S_S)-5-Ethoxy-3-*p*-Tolylsulfinylfuran-2(5*H*)-ones as Chiral Dipolarophiles: First Asymmetric Cycloaddition of Diazomethane to Vinyl Sulfoxides**". *Tetrahedron: Asymmetry* **1996**, *7*, 1943-1950.

    2. García Ruano, J. L; Fraile, A. and Martín, M. R. "**1,3-Cycloaddition of Nitrile Oxides to Cyclic and Open-Chain 4-Oxo-2-sulfinylbut-2-enoic Acid Derivatives**". *Tetrahedron* **1999**, *55,* 14491-14500.

    3. García Ruano, J. L.; Bercial, F.; Fraile, A.; Martín Castro, A. M. and Martín, M. R. "**Stereoselectivity control in Diels-Alder reactions of 4-thiosubstituted 5-alcoxyfuranones: synthesis and reactivity of enantiopure 4-sulfinyl and sulfonyl 5-(*l*-menthyloxy)furan-2(5*H*)-ones**". *Tetrahedron: Asymmetry* **2000**, *11*, 4737-4752.

    4. García Ruano, J. L.; Bercial, F.; Fraile, A. and Martín, M. R. "**A New Entry to Isoxazolo[4,5-*d*]pyridazin-4(5*H*) [and 7(6*H*)]-ones from Funcionalized Vinyl Sulfoxides**". *Synlett* **2002**, 73.

    5. García Ruano, J. L.; Fraile, A.; González, G.; Martín, M. R.; Clemente, F. R. and Gordillo, R. "**The Role of Steric and Electronic Interactions in the Stereocontrol of the Asymmetric 1,3-Dipolar Reactions of 5-Ethoxy-3-*p*-(*S*)-tolylsulfinylfuran-2(5*H*)-ones with Diazoalkanes: Theoretical Calculations and Experimental Evidences**". *J. Org. Chem.* **2003**, *68*, 6522-6534.

    6. García Ruano, J. L.; Andrés Gil, J. I.; Fraile, A.; Martín Castro, A. M. and Martín, M. R. "**Asymmetric 1,3-Dipolar Reactions of 3-Sulfinylfuran-2(5*H*)-ones with 11*H*-dibenzo[*b*,*e*]azepine 5-oxide. Synthesis of Pyrroloazepines *via* Isoxazoloazepines**". *Tetrahedron Lett.* **2004**, *45*, 4653-4656.

    7. García Ruano, J. L.; Alonso, M.; Fraile, A.; Martín, M. R.; Peromingo, M. T. and Tito, A. "**Asymmetric Synthesis of Cyclopropanes from Sulfinylpyrazolines Mediated by Acids**". *Phosphorus, Sulfur, and Silicon and the Related Elements* **2005**, *180*, 1441-1442.

    8. García Ruano, J. L.; Fajardo, C.; Fraile, A. and Martín, M. R. "**Nucleophilic Epoxidation of α-Sulfonyl-α,β-Unsaturated Esters with *m*-CPBA**". *Phosphorus, Sulfur, and Silicon and the Related Elements* **2005**, *180*, 1489-1490.

    9. García Ruano, J. L.; Fajardo, C.; Fraile, A. and Martín, M. R. "**MCPBA/KOH: An Efficient Reagent for Nucleophilic Epoxidation of *gem*-Deactivated Olefines**". *J. Org. Chem.* **2005**, *70*, 4300-4306.

10. García Ruano, J. L.; Fraile, A.; Martín, A. M. and Martín, M. R. "**The Role of the Sulfinyl Group on the Course of the Reactions of 3-p-Tolylsulfinylfuran-2(5H)-ones with Nitrones. Synthetic Uses of Cycloreversion Processes**". *J. Org. Chem.* **2005**, *70*, 8825-8834.

11. García Ruano, J. L.; Peromingo, M. T.; Alonso, M.; Fraile, A.; Martín, M. R. and Tito, A. "**1,3-Dipolar Cycloadditions of Diazoalkanes to Activated Sulfoxides: Influence of Lewis Acids**". *J. Org. Chem.* **2005**, *70*, 8942-8947.

12. García Ruano, J. L.; Fraile, A.; Martín, M. R. and Nuñez, A. "**First Asymmetric Cycloaddition of Carbonyl Ylides to Vinyl Sulfoxides and Furan-2(5*H*)-ones**". *J. Org. Chem.* **2006**, *71*, 6536-6541.

13. García Ruano, J. L.; Alonso, M.; Cruz, D.; Fraile, A.; Martín, M. R.; Peromingo, M. T.; Tito, A.; Yuste, F. "**Synthesis of bicyclo[3.1.0]hexanones via 1,3-dipolar cycloaddition of diazoalkanes to homochiral α-sulfinyl-2-cyclopentenones**". *Tetrahedron* **2008**, *64*, 10546-10551.

14. García Ruano, J. L.; Fraile, A.; Martín, M. R.; Gonzalez, G.; Fajardo, C. "**Pyrrolo[2,1-*b*]thiazole Derivatives by Asymmetric 1,3-Dipolar Reactions of Thiazolium Azomethine Ylides to Activated Vinyl Sulfoxides**". *J. Org. Chem.* **2008**, *73*, 8484-8490.

15. García Ruano, J. L.; Nuñez Jr., A.; Martín, M. R.; Fraile, A. "**Totally Regio- and Stereoselective Behavior of Mono- and Diactivated Cyclic Alkenes in the Lu Reaction: Synthesis of Enantiopure Functionalized Cyclopentanes**". *J. Org. Chem.* **2008**, *73*, 9366-9371.

16. García Ruano, J. L.; Fajardo, C.; Fraile, A.; Martín, M. R.; Soriano, J. F.; "**Synthesis of condensed isoxazolines and isoxazolidines *via* cycloaddition to furan-2(5*H*)-ones**". *Arkivoc* **2010**, 303-318.

17. Fraile, A.; García Ruano, J. L.; Martín, M. R.; Tito, A. "**Asymmetric synthesis of 4-ethoxy-1-p-tolylsulfonyl-3,6-dioxabicyclo[3.1.0]hexan-2-ones**". *Tetrahedron* **2010**, *66*, 235-241.

18. Núñez Jr., A.; Martín, M. R., Fraile, A.; García Ruano, J. L. "**Abnormal Behaviour of Allenylsulfones under Lu's Reaction Conditions. Synthesis of Enantiopure Polyfunctionalized Cyclopentenes**". *Chem. Eur. J.* **2010**, *16*, 5443-5453.

19. Fraile, A.; Martín, M. R.; García Ruano, J. L.; Díaz, J. A.; Arranz, E. "**Efficient synthesis of new 3-heteroaryl-1-functionalized 1H-indazoles**". *Tetrahedron*, **2011**, *67*, 100-105.

20. García Ruano, J. L.; Fraile, A.; Martín, M. R.; González, G.; Fajardo, C.; Martín-Castro, A. M. "**Asymmetric Synthesis of Pyrrolo[2,1-*a*]isoquinoline Derivatives by 1,3-Dipolar Cycloadditions of Stabilized Isoquinolinium *N*-Ylides with Sulfinyl Dipolarophiles**". *J. Org. Chem.* **2011**, *76*, 3296-3305.

21. Yuste, F.; Hernández Linares, A.; Mastranzo, V. M.; Ortiz, B.; Sánchez-Obregón, R.; Fraile, A.; García Ruano, J. L. "**Methyl Sulfinates as Electrophiles in Friedel-Crafts Reactions. Synthesis of Aryl Sulfoxides**". *J. Org. Chem.* **2011**, *76*, 4635-4644.

22. García Ruano, J. L.; Fraile, A.; Nuñez, A.; Martín, M. R.; Alonso, I. "**C-[o-(p-Tolyl)sulfinyl]phenylnitrones. Synthesis and Reactivity in [3+2] Dipolar Cycloadditions**". *Heterocycles* **2012**, *84*, 913-928.

23. García Ruano, J. L.; Alemán, J.; Marzo, L.; Alvarado, C.; Tortosa, M.; Díaz-Tendero, S.; Fraile, A. "**Arylsulfonylacetylenes as Alkynylating Reagents of Csp2-H Bonds Activated with Lithium Bases**". *Angew. Chem. Int. Ed.* **2012**, *51*, 2712-2716. (Highlighted as "Hot Paper" by *Angew. Chem. Int. Ed.* and by *Synfacts* **2012**, *8*, 660).

24. Fraile, A.; Scarpino Schietroma, D. M.; Albrecht, A.; Davis, R. L.; Jørgensen, K. A. "**Asymmetric Synthesis of Hexahydropyrrolo-isoquinolines via an Organocatalytic Three-Component Reaction**". *Chem. Eur. J.* **2012**, *18*, 2773-2776. (Highlighted by *Synfacts* **2012**, *8*, 560).

25. García Ruano, J. L.; Alemán, J.; Marzo, L.; Alvarado, C.; Tortosa, M.; Díaz-Tendero, S.; Fraile, A. "**Expanding the Scope of Arylsulfonylacetylenes as Alkynylating Reagents and Mechanistic Insights in the Formation of Csp2-Csp and Csp3-Csp Bonds from Organolithiums**". *Chem. Eur. J.* **2012**, *18*, 8414-8422. (Highlighted by *Chem. Eur. J.* as "VIP article" and as a "Cover Picture **2012**, Vol. 18, issue 27).

26. Albrecht, A.; Morana, F.; Fraile, A.; Jørgensen, K. A. "**Organophosphorus Reagents in Organocatalysis: Synthesis of Optically Active α-Methylene-δ-lactones and δ-Lactams**". *Chem. Eur. J.* **2012**, *18*, 10348-10354.

27. Alemán, J.; Fraile, A.; Marzo, L.; García Ruano, J. L.; Izquierdo, C.; Díaz-Tendero, S. "**Enantioselective Synthesis of 4-Isoxazolines by 1,3-Dipolar Cycloadditions of Nitrones to Alkynals Catalyzed by Fluorodiphenylmethylpyrrolidines**". *Adv. Synth. Catal.* **2012**, *354*, 1665-1671.

28. Albrecht, Ł; Cruz Acosta, F.; Fraile, A.; Albrecht, A.; Christensen, J.; Jørgensen, K. A. "**Enantioselective H-Bond-Directing Approach for Trienamine-mediated Reactions in Asymmetric Synthesis**". *Angew. Chem. Int. Ed.* **2012**, *51*, 9088-9092. (Highlighted by *Synfacts* **2012**, *8*, 1257).

29. García Ruano, J. L.; Soriano, J. F.; Fraile, A.; Martín, M. R.; Nuñez, A. "**Regio- and stereoselective synthesis of pyrrolo or azepine-fused cyclopenta[*d*]isoxazolines from 2-*p*-tolylsulfinylcyclopent-2-en-1-one**". *J. Sulfur. Chem.* **2013**, *34*, 17-32.

30. Izquierdo, C.; Barrera, J. L.; Fraile, A.; Alemán, J. "**1,4-Michael additions of cyclic-β-ketoesters catalyzed by DNA in aqueous media**". *Cat. Commun.* **2014**, *44*, 10-14.

31. Fraile, A.; Parra, A.; Tortosa, M. Alemán, J. "**Organocatalytic transformations of alkynals, alkynones, propriolates, and related electron-deficient alkynes**". *Tetrahedron* **2014**, *70*, 9145-9173.

32. Izquierdo, C.; Esteban, F.; Parra, A.; Alfaro, R.; Alemán, J.; Fraile, A.; García Ruano, J. L. "**Control of the Dual Reactivity (Iminium-Dienamine) of beta-Arylmethyl alpha,beta-Unsaturated Aldehydes in Organocatalytic 1,3-Dipolar Cycloadditions with *N*-Benzoyl *C,N*-Cyclic Azomethine Imines**". *J. Org. Chem.* **2014**, *79*, 10417-10433.

33. Fraile, A; Alemán, J. "**Inter- and Intramolecular Dienamine Organocatalytic Strategies for the Synthesis of Tetrahydroisoquinolines and Tricyclic Derivatives via [3+2] and [4+2] Cycloadditions**". *Synlett* **2015**, 1940-1954.

34. Izquierdo, C.; Esteban, F.; García Ruano, J. L.; Fraile, A.; Alemán, J. "**Asymmetric Synthesis of 1,2-Diamines bearing Tetrasubstituted Centers from Nonstabilized Azomethine Ylides and N-Sulfinylketimines under Brønsted Acid Catalysis**" *Org. Lett.* **2016**, *18*, 92-95.

35. Esteban, F.; Boughani, L.; García Ruano, J. L.; Fraile, A.; Alemán, J. "**"Anti-Michael addition" of Grignard reagents to sulfonylacetylenes: synthesis of alkynes**" *Org. Biomol. Chem.* **2017**, *15*, 3901.

36. Guerrero-Corella, A.; Martinez-Gualda, A. M.; Ahmadi, F.; Ming, E.; Fraile, A.; Alemán, J. "**Thiol–ene/oxidation tandem reaction under visible light photocatalysis: synthesis of alkyl sulfoxides**" *Chem. Commun.* **2017**, 53, 10463. (Highlighted by *Chem. Commun.* as "Most downloaded articles of 2017: Catalysis").

37. Frías, M.; Carrasco, A. C.; Fraile, A.; Alemán, J. "**A General Asymmetric Formal Synthesis of Aza-Baylis–Hillman Type Products under Bifunctional Catalysis**" *Chem. Eur. J.* **2018**, *24*, 3117. (Highlighted by *Chem. Eur. J.* as "Cover Picture" **2018**, *24* (13)).

38. Esteban, F.; Ciéslik, W.; Arpa, E. M.; Guerrero-Corella, A.; Díaz-Tendero, S.; Perles, J.; Fernandez-Salas, J. A.; Fraile, A.; Alemán, J. "**Intramolecular Hydrogen Bond Activation: Thiourea-Organocatalyzed Enantioselective 1,3-Dipolar Cycloaddition of Salicylaldehyde-Derived Azomethine Ylides with Nitroalkenes**" *ACS Catal.* **2018**, *8*, 1884. (Highlighted as one of the most read article in *ACS Catal.*)

39. Guerrero-Corella, A.; Esteban, F.; Iniesta, M.; Martín-Somer, A.; Parra, M.; Díaz-Tendero, S.; Fraile, A.; Alemán, J. "**2-Hydroxybenzophenone as Chemical Auxiliary for the Activation of Ketiminoesters in the Highly Enantioselective Addition to Nitroalkenes under Bifunctional Catalysis**" *Angew. Chem. Int. Ed.* **2018**, *57*, 5350.

40. Choubane, H.; Garrido-Castro, A. F.; Alvarado, C.; Martín-Somer, A.; Guerrero-Corella, A.; Daaou, M.; Díaz-Tendero, S.; Maestro, C.; Fraile, A.; Alemán, J. "**Intramolecular Hydrogen-Bond Activation for the Addition of Nucleophilic Imines: 2-Hydroxybenzophenone as Chemical Auxiliary**" *Chem. Commun.* **2018**, *54*, 3399.

41. Frías, M.; Cieślik, W.; Fraile, A.; Rosado-Abón, A.; Garrido-Castro, A. F.; Yuste, F.; Alemán, J. "**Development and Application of Asymmetric Organocatalytic Mukaiyama and Vinylogous-Mukaiyama-Type Reactions**" *Chem. Eur. J.* **2018**, *24*, 10906.

42. Guerrero-Corella, A.; Asenjo-Pascual, J.; Janardan Pawar, T.; Díaz-Tendero, S.; Martín-Sómer, A.; Villegas Gómez, C.; Belmonte-Vázquez, J. L.; Ramírez-Ornelas, D. E.; Peña-Cabrera, E.; Fraile, A.; Cruz Cruz, D.; Alemán, J. "**BODIPY as electron withdrawing group for the activation of double bonds in asymmetric cycloaddition reactions**" *Chem. Sci.* **2019**, *10*, 4346.

43. Aguilar-Galindo, F.; Tuñón, A. M.; Fraile, A.; Alemán, J.; Díaz-Tendero, S. "**Role of intramolecular hydrogen bonds and electron withdrawing groups in the acidity**

of aldimines and ketimines: a density functional theory study" *Theor. Chem. Acc.* **2019**, *138* (59).

44. Martínez-Gualda, A. M.; Cano, R.; Marzo, L.; Pérez-Ruiz, R.; Luis-Barrera, J.; Mas-Ballesté, R.; Fraile, A.; de la Peña O'Shea, V. A.; Alemán, J. "**Chromoselective access to Z- or E- allylated amines and heterocycles by a photocatalytic allylation reaction**" *Nat. Commun.* **2019**, *10*, 2634.

- ***Communications at Scientific Meetings:***

1. García Ruano, J. L.; Fraile, A. and Martín, M. R. "**Asymmetric Cycloadditions of diazoalkanes to vinyl sulfoxides**". *XXVII Reunión Bienal de la Real Sociedad Española de Química.* **Book of Abstracts, pp 361-362 (S10-C-20)**. La Laguna (Tenerife). July 1999.

2. García Ruano, J. L.; Fraile, A.; Martín Castro, A. M. and Martín, M. R. "**Cycloadditions of nitrones to (*S*$_5$,*S*$_S$)- and (*R*$_5$,*S*$_S$)-5-ethoxy-3*p*-tolylsulfinylfuran-2(5*H*)-ones**". *19th International Symposium on the Organic Chemistry of Sulfur (ISOCS XIX)*. **Book of Abstracts (PP 21)**. Sheffield (United Kingdom). June 2000.

3. García Ruano, J. L.; Fraile, A. and Martín, M. R. "**Cycloadditions of cyclic and acyclic azomethine ylides to (*S*$_5$,*S*$_S$)- and (*R*$_5$,*S*$_S$)-5-ethoxy-3*p*-tolylsulfinylfuran-2(5*H*)-ones**". *19th International Symposium on the Organic Chemistry of Sulfur (ISOCS XIX)*. **Book of Abstracts (PP 52)**. Sheffield (United Kingdom). June 2000.

4. García Ruano, J. L.; Alonso, M.; Fraile, A.; Martín, M. R.; Peromingo, M. T. and Tito, A. "**Asymmetric synthesis of cyclopropanes from sulfinylpyrazolines mediated by acids**". *21th International Symposium on the Organic Chemistry of Sulfur (ISOCS XXI)*. **Book of Abstracts, pp. 129 (P25-Mo)**. Madrid (Spain). July 2004.

5. García Ruano, J. L.; Fajardo, C.; Fraile, A. and Martín, M. R. "**Nucleophilic epoxidation of α-sulfonyl-α,β-unsaturated ester with MCPBA**". *21th International Symposium on the Organic Chemistry of Sulfur (ISOCS XXI)*. **Book of Abstracts, pp. 179 (P18-Tu)**. Madrid (Spain). July 2004.

6. Fraile, A.; García Ruano, J. L.; Martín, M. R.; Nuñez, A. "**Cycloaddition of allenes to vinyl sulfoxides: asymmetric synthesis of polysubstituted cyclopentenes**". *22th International Symposium on the Organic Chemistry of Sulfur (ISOCS XXII)*. **Book of Abstracts, pp. 85 (P17)**. Saitama (Japan). August 2006.

7. García Ruano, J. L.; Martín, M. R.; Fraile, A.; Nuñez, A. "**Cycloaddition of allenes to activated cyclic vinyl sulfoxides: asymmetric synthesis of polysubstituted cyclopentenes**". *Eighth Tetrahedron Symposium. Challenges in Organic Chemistry*. **Book of Abstracts, P1.75**. Berlin, (Germany). June 2007.

8. García Ruano, J. L.; Fraile, A.; Martín, M. R.; Yuste, F.; Cruz, D. "**1,3-Dipolar cycloadditions to 3-*p*-tolylsulfinyl-5,6-dihydropyran-2(2*H*)-one**". *Eighth Tetrahedron Symposium. Challenges in Organic Chemistry*. **Book of Abstracts, P1.79**. Berlin, (Germany). June 2007.

9. García Ruano, J. L.; Martín, M. R.; Fraile, A.; Nuñez, A. "**Reacciones de Cicloadición [3+2] de Alenos a Olefinas Catalizadas por Nucleófilos**". *V Simposio de Investigadores Jóvenes*. **Book of Abstracts, P40**. Santiago de Compostela, (Spain). November 2008.

10. García Ruano, J. L.; Fajardo, C.; Martín, M. R.; Fraile, A. "**Cycloadditions of Azomethine Ylides to t-Butyl (SS,2E)-2-Tolylsulfinyl-4,4-dimethoxybut-2-enoate**". *24th International Symposium on the Organic Chemistry of Sulfur (ISOCS-XXIV)*. **Book of Abstracts, PA-5, p. 89**. Florence (Italy). July 2010.

11. García Ruano, J. L.; Fraile, A.; Martín, M. R.; Nuñez Jr., A. "**Synthesis and Reactivity of Chiral sulfinylnitrone**". *24th International Symposium on the Organic Chemistry of Sulfur (ISOCS-XXIV)*. **Book of Abstracts, PB-8, p. 126**. Florence (Italy). July 2010.

12. Marzo, L.; Alvarado, C.; Tortosa, M.; Díaz-Tendero, S.; Fraile, A.; García Ruano, J. L.; Alemán, J. "**Arylsulfonylacetylenes as Alkynylating Reagents of Csp2-H and Csp3 Bonds**". *XXIV Reunión Bienal de Química Orgánica*. **Book of Abstracts, CO-24, p. 50**. San Sebastian (Spain). July 2012.

13. Marzo, L.; Fraile, A.; Izquierdo, C.; Nuñez, A.; Marcos, V.; Díaz-Tendero, S.; García Ruano, J. L.; Alemán, J. "**Enantioselective Synthesis of 4-Amino[4H]chromenes and 4-Isoxazolines by Activation of Alkynals with Diphenylmethylpyrrolidines Derivatives**". *International Conference: "Catalysis in Organic Synthesis" (ICCOS-2012)*. **Book of Abstracts, P162, p. 254**. Moscow (Russia). September 2012.

14. Albrecht, A.; Morana, F.; Fraile, A.; Jørgensen, K. A. "**Organophosphorus Reagents in Organocatalysis: Synthesis of Optically Active alpha-Methylene-delta-Lactones and delta-Lactams**". *Ischia Advanced School of Organic Chemistry (IASOC 2012): "Organic synthesis at the crossroads of chemical sciences: new frontiers and challenges"*. **Book of Abstracts, P39**. Ischia-Napoles (Italy). September 2012.

15. Marzo, L.; Izquierdo, C.; Núñez, A.; Fraile, A.; Marcos, V.; Díaz Tendero, S.; García Ruano, J. L.; Alemán, J. "**Synthesis of 4-Amino[4H]chromenes and 4-Isoxazolines by Activation of Alkynals with Diphenylmethylpyrrolidines**". *X Simposio de Investigadores Jóvenes RSEQ – Sigma Aldrich*. **Book of Abstracts, Oral communication 10**. Madrid (Spain). November 2013.

16. Izquierdo, C.; Alfaro, R.; Esteban, F.; García Ruano, J. L.; Alemán, J.; Fraile, A. "**Controlling Regio-, Enantio-, and Endo/exo Selectivity in 1,3-Dipolar Cycloadditions of *C,N*-Cyclic Azomethine Imines**". *X Simposio de Investigadores Jóvenes RSEQ – Sigma Aldrich*. **Book of Abstracts, P62**. Madrid (Spain). November 2013.

17. Izquierdo, C.; Esteban, F.; Alfaro, R.; Parra, A.; García Ruano, J. L.; Alemán, J.; Fraile, A. "**Control of the Dual Reactivity (Iminium-Dienamine) of beta-Arylmethyl alpha,beta-Unsaturated Aldehydes in Organocatalytic 1,3-Dipolar Cycloadditions with *N*-Benzoyl *C,N*-Cyclic Azomethine Imines**". *XXV Reunión Bienal de Química Orgánica*. **Book of Abstracts, Flash-49**. Alicante (Spain). June 2014.

18. Izquierdo, C.; García Ruano, J. L.; Alemán, J.; Fraile, A. "**Síntesis asimétrica de 1,2-Diaminas mediante Cicloadicciones 1,3-dipolares entre Iluros de Azometino no Estabilizados y N-terc-Butilsulfinilcetiminas**". *XI Simposio de Investigadores Jóvenes RSEQ – Sigma Aldrich*. **Book of Abstracts, P-53**. Bilbao (Spain). November 2014.

19. Esteban, F.; García Ruano, J. L.; Alemán, J.; Fraile, A. "**A Straightforward Synthesis of Alkynes from Grignard Reagents and Sulfonylacetylenes**". *XI Simposio de Investigadores Jóvenes RSEQ – Sigma Aldrich*. **Book of Abstracts, P-24**. Bilbao (Spain). November 2014.

20. Esteban, F.; Cieslik, W.; Fraile, A.; Alemán, J. "**Enantioselective Organocatalytic [3+2] Cycloaddition Reaction Between Monoactivated Azomethine Ylides and Nitroalkenes"**. *6th EUCHEMS Chemistry Congress*. **Book of Abstracts.** Sevilla (Spain). September 2016.

21. Guerrero, A.; Esteban, F.; Iniesta, M.; Parra, M.; Díaz-Tendero, S.; Fraile, A.; Alemán, J. "**Highly Enantioselective Addition to Nitroalkenes via a Robust Activation of *α*-Iminoesters**". *International Symposium on Synthesis and Catalysis (ISySyCat)*. **Book of Abstract, F21.** Évora (Portugal). September 2017.

22. Fraile, A. "**Nuevas Cicloadiciones [3+2] Organocatalizadas**". *7º Congreso Nacional de Ciencias Básicas*. **Conferencia Plenaria**. Cunduacán (México). October 2017.

23. Guerrero, A.; Esteban, F.; Iniesta, M.; Parra, M.; Díaz-Tendero, S.; Fraile, A.; Alemán, J. "**Highly Enantioselective Addition to Nitroalkenes via a Robust Activation of *α*-Iminoesters**". *XIV Simposio de Investigadores Jóvenes RSEQ – Sigma Aldrich*. **Book of Abstracts.** Badajoz (Spain). November 2017.

24. Martínez Gualda, A. M.; Ming, E.; Guerrero, A.; Fraile, A.; Alemán, J. "**Síntesis de Sulfóxidos mediante una Reacción Tándem Tiol-eno/Oxidación Fotocatalizada**". *XIV Simposio de Investigadores Jóvenes RSEQ – Sigma Aldrich*. **Book of Abstracts.** Badajoz (Spain). November 2017.

25. Guerrero-Corella, A.; Esteban, F.; Ciéslik, W.; Fernández-Salas, J. A.; Parra, M.; Iniesta, M.; Aleman, J.; Fraile, A. "**Intramolecular Hydrogen-Bond Activation of (Ket)imine Glycine Derivatives: Thiourea-Organocatalyzed Enantioselective [3+2]-Cycloaddition and Michael Addition to Nitroalkenes**". *XXVII Reunión Bienal de Química Orgánica*. **Book of Abstract, OC37**. Santiago de Compostela (Spain). June 2018.

26. Guerrero-Corella, A.; Asenjo, J.; Martínez, I.; Fraile, A.; Alemán, J. "**How to prepare a chiral BODIPY? Synthesis of cyclohexyl-BODIPY derivatives**". *12th Spanish-Italian Symposium on Organic Chemistry (SISOC-XII)*. **Book of Abstract, OR-8**. Ferrara (Italy). July 2018.

27. Martínez-Gualda, A. M.; Cano, R.; Marzo, L.; Más-Ballesté, R.; Fraile, A.; Alemán, J. "**Allylic nucleophilic substitution reactions mediated by a new photocatalytic approach**". *7th EuCheMS Chemistry Congress: Molecular frontiers & global challenges*. **Book of Abstract, PO52**. Liverpool (United Kingdom). August 2018.

28. Asenjo Pascual, J.; Guerrero, A.; Martínez, I.; Fraile, A.; Alemán, J. "**How to prepare a chiral BODIPY? Synthesis of cyclohexenyl-BODIPY derivatives**". *XV Simposio de Investigadores Jóvenes RSEQ – Sigma Aldrich*. **Book of Abstract**. Toledo (Spain). November 2018.

29. Guerrero-Corella, A.; Asenjo, J.; Fraile, A.; Alemán, J. "**BODIPY as Electron Withdrawing Group for the Activation of Double Bonds in Asymmetric Cycloaddition Reactions**". *IV Jornada de Promoción de la Investigación Básica*

para estudiantes de Ciencias e Ingenierías. **Book of Abstract**. Mostoles (Spain). April 2019.

30. Marzo, L.; Martínez-Gualda, A. M.; Cano, R.; Pérez-Ruiz, R.; Luis-Barrera, J.; Más-Ballesté, R.; Fraile, A.; de la Peña O'Shea, V. A.; Alemán, J. "**Photocatalytic Allylation Reaction: Chromoselective Access to Z- or E-Allylated Amines, Ethers and Heterocycles**". *XXXVII Reunión Bienal de la RSEQ*. **Book of Abstract, S.12 FP 08**. San Sebastian (Spain). May 2019.

- ***Symposia attended:***

  - ✓ *"New frontiers in Organic Synthesis"*. **7th Foundation Lilly Scientific Symposium**. San Lorenzo del Escorial (Spain). April 2005.
  - ✓ *"Chemistry: Science at the frontier"*. **13th Foundation Lilly Scientific Symposium**. San Lorenzo del Escorial (Spain). April 2008.
  - ✓ "*Visions in Chemistry"*. **Torkil Holm Symposium 2012**. Copenhagen (Denmark). January 2012.
  - ✓ "2nd Organic Chemistry Day at UAM". Madrid (Spain). October 2012.
  - ✓ "3rd Organic Chemistry Day at UAM". Madrid (Spain). October 2013.
  - ✓ "4th Organic Chemistry Day at UAM". Madrid (Spain). October 2014.
  - ✓ "*Chemistry: answers for a better world*". **Foundation Ramón Areces International Symposium**. Madrid (Spain). October 2014.
  - ✓ 5th Organic Chemistry Day at UAM". Madrid (Spain). October 2015.
  - ✓ 6th Organic Chemistry Day at UAM". Madrid (Spain). October 2016.
  - ✓ 7th Organic Chemistry Day at UAM". Madrid (Spain). October 2017.
  - ✓ 8th Organic Chemistry Day at UAM". Madrid (Spain). October 2018.

- ***Participation in sponsored research projects:***

  - ✓ Title of the project: **"Stereoselective cycloadditions and nucleophilic additions of enantiomerically pure sulfinylethylenes (PB96/0035)"**
    Financial entity: **DGICYT**
    From: **01/10/1997** To: **01/10/2000**
    Main researcher: **José Luis García Ruano**

  - ✓ Title of the project: **"New applications of sulfinyl group in asymmetric cycloadditions and in processes based on the stabilization of lithio carbanions (BQU2000-0246)"**
    Financial entity: **DGICYT**
    From: **19/12/2000** To: **19/12/2003**
    Main researcher: **José Luis García Ruano**

  - ✓ Title of the project: **"Sulfinyl-stereocontrolled remote functionalizations of electrophilic and nucleophilic centers. Improvements in the synthesis of enantiopure sulfoxides and in C-S bond cleavage (BQU2003-04012)"**
    Financial entity: **DGICYT**
    From: **15/11/2003** To: **14/11/2006**
    Main researcher: **José Luis García Ruano**

- ✓ Title of the project: **"Development of new synthetic methodologies based on the employment of enantiomerically pure sulfoxides (CTQ2006-06741/BQU)"**
  Financial entity: **DGICYT**
  From: **01/10/2006** To: **30/09/2009**
  Main researcher: **José Luis García Ruano**

- ✓ Title of the project: **"Synthesis of enantiomerically pure cyclopropane derivatives compounds. Development of new enantio- and diastereoselective processes (08/PPQ/003)"**
  Financial entity: **CAM-UAM**
  From: **01/01/2006** To: **31/12/2006**
  Main researcher: **Ana Mª Martín Castro**

- ✓ Title of the project: **"Synthesis of enantiomerically pure compounds using substrates and reactives bearing a sulfinyl group as a chiral auxiliary (CCG07-UAM/PPQ-1849)"**
  Financial entity: **CAM-UAM**
  From: **01/01/2008** To: **31/12/2008**
  Main researcher: **Ana Mª Martín Castro**

- ✓ Title of the project: **"Enantioselective organocatalysis or chiral induction using sulfur functionalized groups in the synthesis of biologicaly interesting compounds (CCG08-UAM/PPQ-4235)"**
  Financial entity: **CAM-UAM**
  From: **01/01/2009** To: **31/12/2009**
  Main researcher: **Mª Belén Cid de la Plata**

- ✓ Title of the project: **"Research of new applications of *ortho*-benzylsulfinylcarbanions and of relations between sulfinylated substrates and organocatalysis (CTQ2009-12168)"**
  Financial entity: **DGICYT**
  From: **01/01/2010** To: **31/12/2013**
  Main researcher: **José Luis García Ruano**

- ✓ Title of the project: **"Development of Highly Efficient Catalytic Methods (Project AVANCAT) (CS2009/PPQ-1634))"**
  Financial entity: **COMUNIDAD DE MADRID**
  From: **01/01/2010** To: **31/12/2013**
  Main researcher: **José Luis García Ruano**

- ✓ Title of the project: **"Search of new alkynylating methods and development of unexploited chemistries on the resulting alkynes (CTQ2012-35957)"**
  Financial entity: **MEC**
  From: **01/02/2013** To: **31/01/2016**
  Main researcher: **José Luis García Ruano**

- ✓ Title of the project: **"Asymmetric Organocatalysis network"**
  Financial entity: **CONACYT (Consejo Nacional de Ciencia y Tecnología de México)**
  From: **08/2015** To: **08/2016**
  Main researcher: **José Alemán**

- ✓ Title of the project: **"New organo- and photo-catalitic approaches for the synthesis of enantiopure products (CTQ2015-64561-R)"**
  Financial entity: **MINECO/FEDER**
  From: **01/01/2016** To: **31/12/2018**

Main researcher: **José Alemán**

- ✓ Title of the project: **"New generation of multifunctional materials for artificial photosynthesis (S2018/NMT-4367)"**
  Financial entity: **CAM**
  From: **01/01/2019** To: **31/12/2022**
  Main researcher: **José Alemán**. Coordinator: **Victor de la Peña O'Shea**

- ✓ Title of the project: **"Controlling organocatalytic and photocatalytic asymmetric processes for the construction of organic molecules (RTI2018-095038-B-I00)"**
  Financial entity: **Ministerio de Ciencia, Innovación y Universidades**
  From: **01/01/2019** To: **31/12/2021**
  Main researcher: **José Alemán**

- ***Participation in relevant research contracts with companies:***

  - ✓ Company: **JANSSEN-CILAG**
    Title: **"Synthesis of heterocyclic compounds"**
    From: **1999** To: **2001**
    Main researcher: **José Luis García Ruano**

  - ✓ Company: **SANOFI-AVENTIS**
    Title: **"Studies on improving intermediate synthesis of several drugs"**
    From: **04/11/2002** To: **06/03/2008**
    Main researcher: **José Luis García Ruano**

- **EDUCATIONAL EXPERIENCE:**

  - **Associate Professor** (Science Faculty, UAM):

    - ✓ Organic Chemistry I laboratories (2nd course). Bachelor in Chemistry. Courses: 2018/2019 (24 h).
    - ✓ Organic Chemistry II laboratories (2nd course). Bachelor in Chemistry. Courses: 2018/2019 (24 h).
    - ✓ Seminars of Organic Chemistry I (2nd course). Bachelor in Chemistry (13 h). Course: 2017/2018, 2018/2019.
    - ✓ Advanced Organic Chemistry I, laboratories (3rd course). Bachelor in Chemistry. Course: 2017/2018 (30 h).
    - ✓ Green Chemistry (4th course). Bachelor in Chemistry (25 h). Courses: 2016/2017.
    - ✓ Guided Training Activities Coordinator. Master's Degree in Organic Chemistry. Courses: 2015/2016 (15 h), 2016/2017 (15 h), 2017/2018 (25 h), 2018/2019 (40 h).
    - ✓ Chemistry (1st course). Bachelor in Environmental Sciences (20 h). Courses: 2015/2016, 2016/2017, 2017/2018, 2018/2019.
    - ✓ Laboratories of Chemistry (1st course). Bachelor in Environmental Sciences (24 h). Courses: 2015/2016, 2016/2017, 2017/2018, 2018/2019.
    - ✓ Advanced Experimentation (4th course). Bachelor in Chemistry (25 h). Courses: 2014/2015.
    - ✓ Laboratories of Chemistry (1st course). Bachelor in Biology (8 h). Courses: 2014/2015.
    - ✓ Seminars of Chemistry (1st course). Bachelor in Biology (20 h). Courses: 2014/2015, 2015/2016.
    - ✓ Advanced Organic Chemistry laboratories (3rd course). Bachelor in Chemistry. Courses: 2013/2014 (30 h), 2014/2015 (60 h), 2015/2016 (30 h).

- ✓ Organic Chemistry laboratories (2nd course). Bachelor in Chemistry. Courses: 2013/2014 (60 h), 2014/2015 (30 h), 2015/2016 (30 h), 2016/2017 (60 h).
- ✓ Materials Science laboratories (3rd course). Bachelor in Chemistry. Courses: 2013/2014 (12 h).
- ✓ Experimentation in Chemistry (2nd course). Bachelor in Chemical Engineering. Courses: 2013/2014 (20 h).
- ✓ Seminars of Advanced Organic Chemistry (3rd course). Bachelor in Chemistry. Courses: 2015/2016 (20 h).

- **Assistant Professor** (Science Faculty, UAM):

  - ✓ Experimentation in Chemistry (2nd course). Bachelor in Industrial Engineering. Courses: 2012/2013 (2.5 credits).
  - ✓ Organic Chemistry laboratories (2nd course). Bachelor in Chemistry. Courses: 2012/2013 (60 h).
  - ✓ Advanced Organic Chemistry laboratories (3rd course). Bachelor in Chemistry. Courses: 2011/2012 (30 h).
  - ✓ Separation and Purification Methods. Master's degree in Organic Chemistry (2 credits). Courses: 2010/2011, 2011/2012.
  - ✓ Experimental Organic Chemistry (3rd course). Bachelor in Chemistry. Courses: 2006/2007 (120 h), 2007/2008 (120 h), 2008/2009 (120 h), 2009/2010 (90 h), 2010/2011 (40 h).
  - ✓ Advanced Experimentation in Organic Chemistry (4th course). Bachelor in Chemistry. Courses: 2000/2001 (180 h), 2003/2004 (180 h), 2005/2006 (90 h), 2008/2009 (45 h).
  - ✓ Experimentation in Organic Synthesis (2nd course). Bachelor in Chemistry. Courses: 1999/2000 (160 h), 2001/2002 (160 h), 2002/2003 (160 h), 2004/2005 (160 h), 2005/2006 (80 h).
  - ✓ Experimentation in Chemistry (2nd course). Bachelor in Chemical Engineering. Courses: 2002/2003 (25 h).

- **Teaching assistant** (Science Faculty, UAM):

  - ✓ Advanced Laboratory II. (5th course). Bachelor in Chemistry (60 h). Courses: 1997/1998, 1998/1999.

- **RESEARCH AND EDUCATIONAL EXPERIENCE**

  - ✓ Supervisor of Master students: Cristina Izquierdo (2011-2012), Francisco Esteban (2012-2013), Andrea Guerrero (2015-2006), Ana C. Carrasco (2015-2016), Manuel Iniesta (2016-2017), Ana M. Martínez (2016-2017), Juan Asenjo (2017-2018).
  - ✓ Supervisor of PhD: Francisco Esteban (defended), Andrea Guerrero (actually in course) and Ana María Martínez Gualda (actually in course).
  - ✓ Supervisor of under-Graduate students (TFG): To date, I have supervised 11 TFG’s.

- **RELEVANT SCIENTIFIC TECHNIQUES AND SKILLS ACQUIRED:**

  - ✓ NMR. Mono and Bidimensional Experiments (Bruker AC-200 and AC-300).
  - ✓ FT-IR (Bruker Vector 22).
  - ✓ HPLC (Perkin-Elmer Integral 4000 and Agilent 1100 Series) and SFC.
  - ✓ Polarimetry.
  - ✓ UV.

- **LANGUAGES:**

  -Spanish, mother language.
  -English: medium oral level and high reading level.

- **REFERENCES:**

- D. Jose Luis García Ruano, Full Professor of Organic Chemistry Department at UAM. Phone: +34 914974701. E-mail: joseluis.garcia.ruano@uam.es.
- Dª María del Rosario Martín Ramos, Associate Professor of Organic Chemistry Department at UAM. Phone: +34 914974703. E-mail: rosario.martin@uam.es.
- D. Karl Anker Jørgensen, Full Professor of Chemistry Department at Aarhus University. Phone: (+45) 8942 3910. E-mail: kaj@chem.au.dk.

March 11th 2019

D. Alberto Fraile Carrasco