



**Stefano Banfi**

 UNIVERSITY OF INSUBRIA



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## Contact data

### Full Professor

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## Biography

Degree in organic chemistry in February 1980 at the University of Milan; after the military service I spent few years collaborating with Prof. S. Colonna in Milan with different grants and as research officer in the laboratories of Prof CJM Stirling at Bangor University (North Wales) for one year (October 1982- October 1983).

In 1985 I was appointed a position as a CNR researcher, and then received a permanent position in the Center directed by Prof. F. Montanari (CNR - Centro Studi e Stereochimica Sistemi Speciali Organici); the collaboration with Prof. Montanari group lasted until November 1998 when I was appointed a position of Associate Professor (Organic Chemistry) at University of Insubria (Varese). Since then I have been working in the Department of Structural and Functional Biology as head of the organic chemistry laboratory and teaching Organic Chemistry, Laboratory of Chemistry and Analytical Chemistry in different courses of the School of Sciences.

## Qualifications and awards

Assistant Professor in Organic Chemistry

## Research interests

As CNR research officer I have been working several years on the catalytic activity of metallo- porphyrins in hydrocarbon oxidations promoted by inorganic oxidants. NaOCl and H<sub>2</sub>O<sub>2</sub> were used as primary oxidants in alkene epoxidations and saturated hydrocarbons oxygenations catalysed by Mn-Tetraarylporphyrins; the reaction mechanism was deeply investigated determining the optimum reaction conditions in relation with the catalyst structures. In those studies the importance of the nature of substituents placed on the periphery of porphyrin skeleton and the importance of the presence of co-catalysts in the reaction medium have been assessed.

Present research interests are in the field of the Phodynamic Therapy applied on tumours (PDT) and the Photodynamic Antimicrobial Chemotherapy (PACT). These two methodologies, although addressed to different cells, shares the same principle i.e. the activation by low energy radiations (visible light or near IR) of molecules characterized by the presence of wide, unsaturated frame. These molecules, generally indicated as Photosensitizers, when excited by a beam of light, induce the energy transfer to the surrounding molecular oxygen, thus producing the highly reactive and cytotoxic singlet oxygen. This

last is able to kill both eucariotic and procariotic cells. The selectivity of the treatment is insured by the different uptake of ionic and non ionic molecules by procarotic and eucariotic cells respectively.

In collaboration with the groups of microbiology and pharmacology of the same Department we are currently studying the in vitro activity of cationic porphyrins on bacteria and that of neutral and low polar compounds on tumour cells. Recent results obtained with a panel of newly synthesized diaryl- and monoaryl-porphyrins are very promising and allow to envisage new powerful photosensitizers for both PDT and PACT.

## Teaching experience and appointments

Since 2003 I am in charge of the following lectures:  
Laboratory of Chemistry for the courses of Biology and Biotechnology  
Organic Chemistry for the course of Biology of Health.  
Organic Chemistry for the course of Labour and Environment Security Engineering  
Organic Chemistry of Natural and Biomimetic Compounds for the course of Advanced Biology

## Representative publications

1- Banfi, Stefano; Montanari, Fernando; Quici, Silvio. Investigation on factors ruling catalytic efficiency and chemical stability of manganese (III) porphyrins in hypochlorous acid-olefin epoxidation: conditions for practical application. *J. Org. Chem.* (1989), 54(8), 1850-9. ISSN:0022-3263.

2-Anelli, Pier Lucio; Banfi, Stefano; Montanari, Fernando; Quici, Silvio. Oxidation of diols with alkali hypochlorites catalyzed by oxammonium salts under two-phase conditions. *J. Org. Chem.* (1989), 54(12), 2970-2. ISSN:0022-3263.

3- Anelli, Pier Lucio; Banfi, Stefano; Montanari, Fernando; Quici, Silvio. Synergistic effect of lipophilic carboxylic acids and heterocyclic axial ligands in alkene epoxidation by hydrogen peroxide catalyzed by manganese(III) tetraarylporphyrins. *J. Chem. Soc., Chem. Commun.* (1989), (12), 779-80. ISSN: 0366-5607

4- Montanari, Fernando; Banfi, Stefano; Quici, Silvio. Oxidations catalyzed by stable metallo-tetraaryl porphyrins under aqueous-organic two-phase conditions. *Pure Appl. Chem.* (1989), 61(9), 1631-6. ISSN:0033-4545.

5- Banfi, Stefano; Maiocchi, Alessandro; Moggi, Alberto; Montanari, Fernando; Quici, Silvio. Hydrogen peroxide oxygenation of alkanes catalyzed by manganese(III) tetraarylporphyrins: the remarkable cocatalytic effect of lipophilic carboxylic acids and heterocyclic bases. *J. Chem. Soc., Chem. Commun.* (1990), (24), 1794-6. ISSN: 0366-5607.

6- Rubino, F. M.; Mascaro, P.; Banfi, S.; Quici, S. Structural study of manganese(III)-tetraarylporphyrin complexes by fast-atom-bombardment mass spectrometry. *Org. Mass Spectrom.* (1991), 26(3), 161-6. ISSN:0030-493X.

7-Banfi, Stefano; Legramandi, Francesco; Montanari, Fernando; Pozzi,

Gianluca; Quici, Silvio. Biomimetic models of cytochrome P-450. A doubly tailed manganese(III)-tetraaryl porphyrin; an extremely efficient catalyst for hydrocarbon oxygenations promoted by 30% hydrogen peroxide. *J. Chem. Soc., Chem. Commun.* (1991), (18), 1285-7. ISSN: : 0366-5607.

8- Banfi, Stefano; Montanari, Fernando; Quici, Silvio; Torosyan, G. Influence of quaternary onium salts, crown ethers and cryptands on olefin epoxidations promoted by hypochlorous acid/hypochlorite in the presence of Mn(III)-tetrakis(2,6-dichlorophenyl)porphyrin chloride. *J. Inclusion Phenom. Mol. Recognit. Chem.* (1992), 12(1-4), 159-73. ISSN:0923-0750.

9- Rubino, Federico Maria; Banfi, Stefano; Pozzi, Gianluca; Quici, Silvio. A study on the solution and gas-phase chemistry of manganese (III) tetraarylporphyrin complexes by fast-atom bombardment mass spectrometry. 1: Generation of molecular signals. *J. Am. Soc. Mass Spectrom.* (1993), 4(3), 249-54. ISSN:1044-0305.

10- Rubino, Federico Maria; Banfi, Stefano; Pozzi, Gianluca; Quici, Silvio. A study on the solution and gas-phase chemistry of manganese (III) and iron(III) tetraarylporphyrin complexes by fast-atom bombardment mass spectrometry. 2: Synthesis and characterization of molecular complexes. *J. Am. Soc. Mass Spectrom.* (1993), 4(3), 255-8. ISSN:1044-0305

11- Anelli, Pier Lucio; Banfi, Stefano; Legramandi, Francesco; Montanari, Fernando; Pozzi, Gianluca; Quici, Silvio. Tailed manganese (III)-tetraarylporphyrins bearing on axial ligand and/or a carboxylic group: self-consistent catalysts for hydrogen peroxide or sodium hypochlorite alkene epoxidation. *J. Chem. Soc., Perkin Trans. 1* (1993), (12), 1345-57. ISSN:0300-922X.

12- Minisci, Francesco; Fontana, Francesca; Zha; Banfi, Stefano; Quici, Silvio. Regio- and-chemo-selectivity of adamantane halogenation by Gif-Barton and Metalloporphyrin Catalysis and by classical free-radical reactions. *Tetrah. Lett.* (1994), 35(43), 8033 – 8036. ISSN 0040-4039.

13- Banfi, Stefano; Montanari, Fernando; Pozzi, Gianluca; Quici, Silvio. Dimeric Mn(III)-tetraarylporphyrins as catalysts for H<sub>2</sub>O<sub>2</sub> promoted olefin epoxidation. *Tetrahedron* (1994), 50(30), 9025-9036. ISSN: 0040-4020.

14- Minisci, F.; Fontana, F.; Araneo, S.; Recupero, F.; Banfi, S.; Quici, S. Kharasch and Metalloporphyrin Catalysis in the Functionalization of Alkanes, Alkenes, and Alkylbenzenes by t-BuOOH. Free Radical Mechanisms, Solvent Effect, and Relationship with the Gif Reaction. *J. Am. Chem. Soc.* (1995), 117(1), 226-32. ISSN:0002-7863.

15- Pozzi, Gianluca; Banfi, Stefano; Manfredi, Amedea; Montanari, Fernando; Quici, Silvio. Towards epoxidation catalysts for fluorine biphasic systems: synthesis and properties of two Mn(III)-tetraarylporphyrins bearing perfluoroalkylamido tails. *Tetrahedron* (1996), 52(36), 11879-11888. B ISSN:0040-4020.

16- Banfi, S.; Cavaliere, C.; Cavazzini, M.; Trebicka, A. Mn-tetraarylporphyrins bearing N-alkyl sulfonamido tails: effect of the length and polarity of the chains on physical properties and reactivity. *J. Mol. Catal. A: Chem.* (2000), 151(1-2), 17-28. ISSN:1381-1169.

17- Banfi, Stefano; Cavazzini, Marco; Pozzi, Gianluca; Barkanova, Svetlana V.; Kaliya, Oleg L. Kinetic studies on the interactions of manganese-porphyrins with peracetic acid. Part 1. Epoxidation of alkenes and hydroxylation of aromatic rings. *J. Chem. Soc. Perkin Trans. 2* (2000), (4), 871-877. ISSN: 1472-779X

18- Banfi, Stefano; Cavazzini, Marco; Pozzi, Gianluca; Barkanova, Svetlana V.; Kaliya, Oleg L. Kinetic studies on the interactions of manganese-porphyrins with peracetic acid. Part 2. The influence of acetic acid and porphyrin substituents. *J. Chem. Soc. Perkin Trans. 2* (2000), (4), 879-885. ISSN: 1472-779X

19- Banfi, Stefano; Cassani, Elisabetta; Caruso, Enrico; Cazzaro, Mersia. Oxidative cleavage of plasmid bluescript by water-soluble Mn-porphyrins and artificial oxidants or molecular oxygen. *Bioorg. Med. Chem.* (2003), 11, 3595 – 3605. ISSN 0968-0896.

20- Banfi, Stefano; Carlucci, Lucia; Caruso, Enrico; Ciani, Gianfranco; Proserpio, Davide. An unusual three-dimensional coordination network formed by parallel polycatenation of two-fold interpenetrated (6,3) layers based on novel three-connecting ligand. *Crystal Growth & Design*, (2004), 4(1), 29 – 32. ISSN 1528-7483.

21- Banfi, Stefano; Caruso, Enrico; Caprioli, Stefania; Mazzagatti, Luigi; Canti, Gianfranco; Ravizza, Raffaella; Gariboldi, Marzia; Monti, Elena. Photodynamic effects of porphyrin and chlorin photosensitizers in human colon adenocarcinoma cells. *Bioorg. Med. Chem.* (2004), 12, 4853-4860. ISSN 0968-0896.

## Clinical interests

In the future I will be interested in the in vivo applications of new photosensitizers for photodynamic therapy applied both on tumour and on bacteria. Collaborations with clinicians will possibly allow the set up of the first clinical trials on specific tumors or on infections.