



Elisabetta Zanardini

 UNIVERSITY OF INSUBRIA



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Biography

March 2005–Present

ASSOCIATE PROFESSOR in General and Environmental Microbiology

School of Sciences in Como

University of Insubria, Italy.

July 2003–Feb 2005

SENIOR RESEARCHER in General and Environmental Microbiology,

Department of Food Science and Microbiology, Faculty of Agriculture,

University of Milan, Italy.

July 2000–July 2003

RESEARCHER in General and Environmental Microbiology,

Department of Food Science and Microbiology, Faculty of Agriculture,

University of Milan, Italy.

Feb 1999–June 2000

POST DOCTORATE on the “Effects of the electrolytic treatment of animal manure on the microflora”

Department of Food Science and Microbiology, Faculty of Agriculture,

University of Milan, Italy.

1995–1998

PhD, “CHEMISTRY, BIOCHEMISTRY & ECOLOGY OF PESTICIDES”

Faculty of Agriculture, University of Milan.

Thesis :-“Microbiological investigation on the degradation and toxicity of tiocarbammate and sulfonylurea herbicides”.

1994–1995

TECHNICIAN by contract

Department of Food Science and Microbiology, Faculty of Agriculture,

University of Milan, Italy.

1993–1994

SCHOLARSHIP on the “Influence and role of microorganisms in the cultural heritage conservation”.

Department of Food Science and Microbiology, Faculty of Agriculture,
University of Milan, Italy.

1989–1991

UNIVERSITY DEGREE IN BIOLOGY

Conferred on 29 April 1991, Faculty of Science, University of Milan.

Thesis title: " Chemiosistemica di Vitis vinifera e Vitis silvestris
attraverso la caratterizzazione delle proteine di parete del polline".

INTERNATIONAL CONFERENCES – Invited Speaker.

July 2002

Symposium on Molecular approaches & standardisation in cultural
heritage, Seville, Spain. Presentation:- "Molecular techniques applied to
the study of microbial communities colonising different lithotypes."

June 2000

International Symposium on Art Biology & Conservation 2002.

Metropolitan Museum of Art , New York , USA.

Presentation:- "Red stains on Carrara marble, a case study of the
Certosa of Pavia, Italy."

October 2000

International Congress on Microbiology in Composting & other
biodegradation processes, Innsbruck, Austria.

Presentation:- "Microbial & biochemical degradation of sulfonylurea
herbicides, chlorsulfuron and metsulfuron-methyl."

August 1999

XI International Biodeterioration & Biodegradation Symposium,
Arlington , Washington, USA:

Presentation:- "The molecular diversity of Geodermatophilus –like
organisms, application for the diagnosis of biodeterioration.

MEMBERSHIP OF NATIONAL COMMISSIONS & SOCIETIES

1999 – Present.

Member of the Ministerial Commission

UNI Normal Commission (Ente Nazionale Italiano di Unificazione) –

Biological group for the elaboration of documents on the study and
control of biodeterioration of artistic stoneworks.

2001 – Present.

Member of the Association to National Microbiological Societies

Member of the Italian Society of Food, Agricultural and Environmental
Microbiology (SIMTREA).

1999 – Present.

Member of the Italian Society of General Microbiology and Microbial
Biotechnology (SIMGBM)

Qualifications and awards

Feb. 1999

LEARNED SPECIALIST "Cultore della Materia" in Agricultural
Microbiology, In the Faculty of Agriculture, at the University of Milan.

1995 – 1998

PhD, "CHEMISTRY, BIOCHEMISTRY AND ECOLOGY OF PESTICIDES"

Faculty of Agriculture, University of Milan

Thesis on "Microbiological investigations of the degradation and toxicity of the Tiocarbamates and sulfonyleureas".

April 1991

UNIVERSITY DEGREE IN BIOLOGY

Conferred on 29 April 1991, Faculty of Science, University of Milan.

Thesis title: " Chemiosistemica di Vitis vinifera e Vitis silvestris attraverso la caratterizzazione delle proteine di parete del polline".

Research interests

Research activities are mainly focused on the microbial ecology and environmental microbiology and on the biodeterioration of artworks and the biotechnology applied to the cultural heritage.

1. Microbiological aspects of the conservation of cultural heritage

Biodeterioration of cultural heritage: diagnosis of the microbial alterations and characterisation of the microorganisms involved in the processes.

The microbiological characterisation is based on traditional cultural methods in order to identify the cultivable fraction of the microbial community present in the bioalterations. In addition microscopic approach are used (i.e. DAPI coloration).

The molecular characterisation is based on PCR based techniques for the research of specific biodeteriorative agents or for the study of the total microbial community (DGGE analysis). In addition Fluorescence In Situ Hybridisation (FISH) is applied to the analysis of bioalterations.

Studies cases:

- Red stains on marbles of the Certosa of Pavia façade
- Black crusts on marble of Milan Cathedral
- Biodegradation of synthetic resins
- Effects of atmospheric pollution on artistic stoneworks

Use of bacteria for the bioremediation /biocleaning of cultural heritage in order to remove salts and organic matter

Since 1995 the possibility to apply bacteria immobilised in inorganic and organic delivery systems was carried in order to remove salts as sulphates and nitrates and organic matter both using artificial specimens and real artistic stoneworks.

European project BIOBRUSH EVK4-2001-00055 - "Novel approaches to conserve our European heritage: BIOremediation for Building Restoration of the Urban Stone Heritage in European States".

Studies cases:

- Frescoes of Camposanto Monumentale at Pisa

- Matera Cathedral
- Milan Cathedral

2. Biodegradation of xenobiotics

Study of the biodegradation of sulfonylurea herbicides and their effect on the soil microbial community

The research started with the study of the biodegradation of chlorsulfuron and metsulfuron herbicides by bacterial and fungal pure cultures (*Pseudomonas stutzeri* and *Aspergillus niger*).

At the moment a new sulfonylurea herbicide is considered named azimsulfuron: biodegradation by soil microflora is evaluated on lab scale microcosms and metabolite production and biodegradation rate by bacterial consortia and pure cultures is evaluated in batch. The effects of this herbicide on soil microbial communities is studied by molecular techniques (16SrDNA DGGE analysis).

3. Environmental biotechnologies

Bioremediation of contaminated environments

Bioremediation studies of soil contaminated by aliphatic and aromatic hydrocarbons on lab scale (microcosms and biopiles) and microbiological and molecular characterisation of the microbial population involved in the biodegradation processes.
 Bioremediation studies of water contaminated by methyl tert-butyl ether (MTBE), a primary constituent of reformulated gasoline, and microbiological and molecular characterisation of the microbial population involved in the biodegradation processes.
 Wastewater treatment plants: studies of the effects of the metal toxicity in municipal wastewater activated sludge by multivariate analysis and in situ hybridisation (Fluorescence In Situ Hybridisation).

Teaching experience and appointments

2001-Present

University Courses

“Microbiology with laboratory” course, 24 hours lectures, 11 hours laboratory

Environmental Science Degree (Triennial Degree)

School of Sciences in Como at the University of Insubria

2003-Present

“Environmental Microbiology with laboratory” course, 32 hours lectures, 22 hours laboratory

Environmental Science Degree (Specialistic Degree)

School of Sciences in Como at the University of Insubria

2002-Present

“Biotechnology applied to the conservation of cultural heritage” course
 24 hours lectures, 16 hours laboratory.

Agricultural biotechnology Degree (Triennial Degree)

Faculty of Agriculture, University of Milan.

2000-2002

“Quality control: microbiological analyses of the enological products”
course

8 hours lectures, 48 hours laboratory.

Viticulture and Enology Degree (Triennial Degree)

Faculty of Agriculture, University of Milan.

2001-2003

Masters Courses

“Microbiology applied to cultural heritage”

24 hours lectures, 16 hours laboratory.

Masters in “Science applied to cultural heritage”

Faculty of Science, University of Milan.

Examination boards

Member of the examination boards for the courses:

“Microbiology with laboratory”

“Environmental microbiology with laboratory”

“Biotechnology Applied to Cultural Heritage” at the
University of Insubria-Como and University of Milan.

Student supervision

Supervision of more than 25 university graduate theses in:

- Environmental Science Triennial Degree, School of Sciences in Como at the University of Insubria
- Environmental Science Specialistic Degree, School of Sciences in Como at the University of Insubria
- Agricultural biotechnology Triennial Degree, Agricultural Faculty, University of Milan.
- Reference for the Faculty of Science for the “Services to disabled students ” at the University of Insubria.

Representative publications

1. Principi P., Villa F., Bernasconi M., Zanardini E. 2005. Metal toxicity in municipal wastewater activated sludge investigated by multivariate analysis and in situ hybridisation. *Water Research*. Accepted and in press.

2. Valle, G. Boschini, M. Negri, P. Abbruscato, C. Sorlini, A. D'Agostina, E. Zanardini. 2005. The microbial degradation of azimsulfuron and its effects on the soil bacterial community. *J. Appl. Microbiol.* Accepted and in press.

3. Cappitelli F., Vicini S., Piaggio P., Abbruscato P., Princi E., Casadevall A., Nosanchuk J. D., Zanardini E. 2005. "Investigation of fungal deterioration of synthetic paint binders using vibrational spectroscopic techniques", *Macromolecular Bioscience*, 5, 49-57.

4. Realini M., Colombo C., Sansonetti A., Rampazzi L., Colombini M.P., Bonaduce I., Zanardini E., Abbruscato P. 2005. Oxalate films and red stains on Carrara marble. *Annali di Chimica*, 95, 217-226.

5. Ranalli G., Alfano G., Belli C., Lustrato G., Colombini M. P., Bonaduce I., Zanardini E., Abbruscato P., Cappitelli F., Sorlini C. 2005.

Biotechnology applied to cultural heritage: biorestitution of frescoes using viable bacterial cells and enzymes, *J. Appl. Microbiol.*, 98, 73-83.

6. Laguardia L., Vassallo E., Cremona A., Cappitelli F., Zanardini E., Vicini S., Princi E., Mesto E., Cagna M. 2005. "Conservation of biodeteriorated ancient documents and paper consolidation by plasma treatments" in 14th ICOM-CC Triennial Meeting The Hague, 12-16 September 2005, ed. Vontobel R., James & James (Science Publishers) Ltd.: London, Vol. I, 193-198.

7. Cappitelli F., Zanardini E., Sorlini C. 2004. The Biodeterioration of Synthetic Resins used in Conservation, *Macromolecular Bioscience* 4, 399-406.

8. Negri M., Manfredini A., Saponaro S., Sorlini C., Bonomo L., Valle A., Zanardini E. 2004. Solid phase treatment of an aged soil contaminated by polycyclic aromatic hydrocarbons. *J. Environ. Sci. Health*, A39, 1, 1-17.

9. Boschin G., D'Agostina A., Arnoldi A., Marotta E., Zanardini E., Negri M., Valle A., Sorlini C. 2003. Biodegradation of chlorsulfuron and metsulfuron-methyl by *Aspergillus niger* in laboratory conditions. *J. Environ. Sci. Health*, B38, 6, 737-746.

10. Principi P., Ranalli G., da Borso F., Pin M., Zanardini E., Sorlini C. 2003. Microbiological aspects of humid husk composting. *J. Environ. Sci. Health*, B38, 5, 645-661.

11. Lustrato G., Alfano G., Belli C., Grazia L., Iorizzo M., Maiuro L., Massarella F., Zanardini E. and Ranalli G. 2003. Controlling grape must fermentation in early winemaking phases: the role of electrochemical treatment. *J. Appl. Microbiol.*, 95, 1087-1095.

12. Ranalli G., Zanardini E., Pasini P., Roda A. 2003. Rapid biodeteriogen and biocide diagnosis on artworks: a bioluminescent low-light imaging technique. *Ann. Microbiol.*, 53, 1-13.

13. Zanardini E., Abbruscato P., Scaramelli L., Onelli E., Realini M., Patrignani G., Sorlini C. 2003. Red stains on Carrara marble: a case study of the Certosa of Pavia, Italy. In: *Art, Biology, and Conservation: Biodeterioration of Works of Art*. (Eds. R.J. Koestler, V.H. Koestler, A.E. Charola, F.E. Nieto-Fernandez), The Metropolitan Museum of Art Pub., New York: pp. 226-247.

14. Abbruscato P., Sorlini C., Zanardini E. 2003. Molecular characterization of lead-resistant isolates from Certosa of Pavia red stains. In: *Molecular biology and cultural heritage*. (Ed. C. Saiz-Jimenez), Swets & Zeitlinger, Lisse: pp. 109-113.

15. Ranalli G., Iorizzo M., Lustrato G., Zanardini E., Grazia L. 2002. Effects of low electric treatment on yeast microflora. *J. Appl. Microbiol.*, 93, 877-883.

16. Zanardini E., Pisoni C., Ranalli G., Zucchi M., Sorlini C. 2002. Methyl tert-butyl ether (MTBE): bioremediation studies. *Ann. Microbiol.*,

52, 207-221.

17. Zanardini E., Valle A., Gigliotti C., Papagno G., Ranalli G., Sorlini C. 2002. Laboratory-scale trials of electrolytic treatment on industrial wastewaters: microbiological aspects. *J. Environ. Sci. Health*, A37, 8, 1463-1481.

18. Zanardini E., Arnoldi A., Boschini G., D'Agostina A., Negri M., Sorlini C. 2002. Degradation pathways of chlorsulfuron and metsulfuron-methyl by a *Pseudomonas fluorescens* strain. *Ann. Microbiol.*, 52, 25-37.

19. Cappitelli F., Zanardini E., Principi P., Realini M., Sorlini C. 2002. "The biodegradability of synthetic resins used as binding media in housepaints", in *Plastics in Art. History, Technology and Preservation*, ed. van Oosten T., Shashoua Y. Munich: Siegl, 124-133.

20. Zanardini E., Arnoldi A., Boschini G., D'Agostina A., Negri M., Sorlini C. (2002). Microbial degradation of sulfonylurea herbicides: chlorsulfuron and metsulfuron-methyl. In: *Microbiology of Composting*. (Eds. H. Insam, N. Riddech, S. Klammer), Springer-Verlag, Berlin: pp. 309-319.

21. Zanardini E., Abbruscato P., Ghedini N., Realini M., Sorlini C. 2000. Influence of atmospheric pollutants on the biodeterioration of stone. *Int. Biodeter. Biodegr.*, 45, 35-42.

22. Daffonchio D., Borin S., Zanardini E., Abbruscato P., Realini M., Urzi C., Sorlini C. (2000). Molecular tools applied to the study of deteriorated artworks. In: *Of Microbes and Art: the role of microbial communities in the degradation and protection of cultural heritage*. (Eds. O. Ciferri, P. Tiano and G. Mastromei), Kluwer Academic/Plenum Publishers, New York, pp. 21-38.

23. Ranalli G., Matteini M., Tosini I., Zanardini E., Sorlini C. (2000). Bioremediation on cultural heritage: removal of sulphates, nitrates and organic substances. In: *Of Microbes and Art: the role of microbial communities in the degradation and protection of cultural heritage*. (Eds. O. Ciferri, P. Tiano and G. Mastromei), Kluwer Academic/Plenum Publishers, New York, pp. 231-245.

24. Daffonchio D., Zanardini E., Vatta P., Sorlini C. 1999. Cometabolic degradation of thiocarbamate herbicides by *Streptomyces* sp. strain M2 and effects on the cell metabolism. *Ann. Microbiol. Enzimol.*, 49, 13-22.

25. Ranalli G., Chiavarini M., Guidetti V., Marsala F., Matteini M., Zanardini E., Sorlini C. 1997. The use of microorganisms for the removal of sulphates on artistic stoneworks. *Int. Biodeter. Biodegr.*, 40, (2-4), 255-261.

26. Zanardini E., Andreoni V., Borin S., Cappitelli F., Daffonchio D., Talotta P., Sorlini C., Ranalli G., Bruni S., Cariati F. 1997. Lead-resistant microorganisms from red stains of marble of the Certosa of Pavia (Italy) and use of nucleic acids based techniques for their

detection. *Int. Biodeter. Biodegr.*, 40, (2-4), 171-182.

27. Bruni S., Cariati F., Bianchi C.L., Zanardini E., Sorlini C. 1995. Spectroscopic investigation of red stains affecting the Carrara marble façade of the Certosa of Pavia. *Archeometry*, 37, (2), 249-255.

28. Sorlini C., Zanardini E., Albo S., Praderio G., Cariati F., Bruni S. 1994. Research on chromatic alterations of marbles from the fountain of Villa Litta (Lainate, Milan). *Int. Biodet. Biodegr.*, 33, 153-164.

29. Daffonchio D., Monaco G., Zanardini E., Sorlini C. 1994. AP-PCR fingerprinting of *Pseudomonas* strains isolated from different environmental matrices. *Med. Fac. Landbouww*, 59/4b, 2121-2129.

30. Praderio G., Schiraldi A., Sorlini C., Stassi A., Zanardini E. 1993. Microbiological and calorimetric investigations on degraded marbles from the Cà d'Oro façade (Venice). *Thermochimica Acta*, 227, 205-213.