# Detailed CV


Birth: December 6, 1940, St. Ulrich, Italy

Marital status: married with Anne Marie Hellrigl, 1 child

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**Academic education**

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| 1959 - 1965 | Chemistry at the University of Padova, Italy; graduate training in peptide chemistry in the laboratories of Prof. E. Scoffone |
| 1965: | Doctorate in Chemistry with summa cum laude: On the synthesis of the N-terminal eicosapeptide of ribonuclease A. |

**Professional activities**

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| 1965 - 1967 | Research assistant at the Institute of Organic Chemistry, University of Padova, Italy. |
| 1968 - 1969 | Research associate at the Protein Research Laboratory (Prof. K. Hofmann), University of Pittsburgh. |
| 1975 - 1991 | Staff scientist at the Max-Planck-Institute of Biochemistry, Department of Peptide Chemistry, Martinsried, Germany. |
| 1971 | Habilitation in Chemistry of Natural Products, Padova, Italy |
| 1988 | Habilitation at the Technical University of Munich, Faculty of Chemistry, Biology and Geology. |
| 1990 | Visiting Professor, Protein Research Institute, University of Osaka, Japan |
| 1991- | Head of the Laboratory of Bioorganic Chemistry, Institute of Biochemistry, Martinsried, Germany. |
| 1992 | Visiting Professor, University of Padova, Italy |
| 1994- | Apl. Professor, Technical University of Munich |
| 1997 | Visiting Professor, University of Neaples |
| 1997-1998 | Professor of Biochemistry and Biotechnology, TU München |

**Awards**

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| 1995 | Max-Bergmann-Medal |
| 2004 | Josef Rudinger Award |
| 2008 | Dimitrios Theodoropoulos Memorial Lecturer |
| 2011 | Doctor honoris causa, University of Cergy-Pontoise, Paris |
| 2018 | Akabori Memorial Award 2018 |
| 2020 | Ernesto Scoffone Award |

Author and coauthor of 669 publications (491 in peer-reviewed journals and 178 as contributions to proceedings and books)
Co-Editor of the 5-volume treatise *Houben-Weyl, Methods of Organic Chemistry, Synthesis of Peptides and Peptidomimetics* (Goodman, M.; Felix, A.; Moroder, L.; Toniolo, C., eds.) E 22a-e, Georg Thieme Verlag, Stuttgart, 2002/2003.
Co-Editor of the book *Oxidative Folding of Peptides and Proteins* (J. Buchner, L. Moroder) RSC, Cambridge, 2009
Editor-in-Chief of the *Journal of Peptide Science* (2008- …)

**Reviewer Activity for Journals**
Journal American Chemical Society, Organic Letters, Journal of Organic Chemistry, Biochemistry, Journal of Medicinal Chemistry, Bioorganic and Medicinal Chemistry, Angewandte Chemie, Chemistry-A European Journal, ChemBioChem, ChemMedChem, Biological Chemistry, Chemistry & Biology, Synthesis, Biopolymers, Biopolymers-Peptide Science, International Journal of Peptide Research and Therapeutics

**Scientific Societies**
European Peptide Society
American Peptide Society
Council of the European Peptide Society (1972-1974: representative of Italy)
Council of the European Peptide Society (1997-2006: representative of Germany)
Scientific Secretary of the MBK (1980-2003)
Head of the scientific advisory board of the MBK (2004-2011)
Editorial Advisory Board of Biopolymers

**Research projects of the last years with selected publications**

***Synthesis of cystine-rich peptides:*** Single- and multiple-stranded cystine peptides, selenocystine-peptides.


1) Besse, D.; Siedler, F.; Diercks, T.; Kessler, H.; Moroder, L. (1997) The redox potential of selenocystine in unconstrained cyclic peptides. *Angew. Chem. Int. Ed*. **36**, 883-885.
2) Pegoraro, S.; Fiori, S.; Rudolph-Böhner, S.; Watanabe, T. X.; Moroder, L. (1998) Isomorphous replacement of cystine with selenocystine in endothelin. Oxidative refolding, biological and conformational properties of [$Sec^3$,$Sec^{11}$,$Nle^7$]-endothelin-1. *J. Mol. Biol*. **284**, 779-792.
3) Milbradt, A. G.; Boulegue, C.; Moroder, L.; Renner, C. (2005) The two cysteine-rich head domains of minicollagen from *Hydra* nematocysts differ in their cystine framework and overall fold despite an identical cysteine sequence pattern. *J. Mol. Biol*. 354, 591-600.
4) Boulègue, C.; Milbradt, A. G.; Renner, C.; Moroder, L. (2006) Single proline residues can dictate folding pathways of cysteine-rich peptides. *J. Mol. Biol.* **358**, 846-856.
5) Reviewed in Moroder, L.; Musiol, H.-J.; Götz, M.; Renner, C. (2005) Synthesis of single- and multiple-stranded cystine-rich peptides. *Biopolymers (Peptide Science)* **80**, 85-97.
6) Arai, K.; Takei, T.; Okumura, M.; Watanabe, S.; Amagai, Y.; Asahina, Y.; Moroder, L.; Hojo, H.; Inaba, K.; Iwaoka. I. (2017) Preparation of selenoinsulin as a long-lasting insulin analogue. *Angew. Chem. Int. Ed*. 56, 5522-5526; DOI: 10.1002/anie.201701654; Angew. Chem. 129, 5614 –5618; DOI: 10.1002/ange.201701654


***Hormone receptors*:** Characterization of ligand binding sites of peptide hormone receptors by the combined use of analogues and receptor mutations.


1) Moroder, L.; Romano, R.; Guba, W.; Mierke, D. F.; Kessler, H.; Delporte, C.; Winand, J.; Christophe, J. (1993) New evidence for a membrane-bound pathway in hormone receptor binding. *Biochemistry* **32**, 13551-13559.
2) Giragossian, C.; Schaschke, N.; Moroder, L.; Mierke, D. F. (2004) Conformational and molecular modeling studies of beta-cyclodextrin-heptagastrin and the third extracellular loop of the cholecystokinin 2 receptor. *Biochemistry* **43**, 2724-2731.
3) Archer-Lahlou, E.; Escrieut, C.; Clerc, P.; Martinez, J.; Moroder, L.; Logsdon, C.; Kopin, A.; Seva, C.; Dufresne, M.; Pradayrol, L.; Maigret, B.; Fourmy, D. (2005) Molecular mechanism underlying partial and full agonism mediated by the human cholecystokinin-1 receptor. *J. Biol. Chem*. **280**, 10664-10774.
4) Cordelier, P.; Estève, J.-P.; Najib, S.; Moroder, L.; Vaysse, N.; Pradayrol, L.; Susini, C.; Buscali, L. (2006) Regulation of Neuronal Nitric-oxide Synthase Activity by Somatostatin Analogs following SST5 Somatostatin Receptor Activation. *J. Biol. Chem*. **281**, 19156-19171.


***Collagen peptides as models of the extracellular matrix*:** Heterotrimeric collagen peptides as substrates of collagenases for studying the mechanism of collagen catabolism by MMPs and as integrin ligands to identify the characterize the cell adhesion epitopes.


1) Ottl, J.; Moroder, L. (1999) Disulfide-bridged heterotrimeric collagen peptides containing the collagenase cleavage site of collagen type I. Synthesis and conformational properties. *J. Am. Chem. Soc*. 121, 653-661.
2) Ottl, J.; Gabriel, D.; Murphy, G.; Knäuper, V.; Tominaga, Y.; Nagase, H.; Bode, W.; Moroder, L. (2000) Recognition and catabolism of synthetic heterotrimeric collagen-peptides by matrix-metalloproteinases. *Chem. Biol*. 7, 119-132.
3) Saccà, B.; Renner, C.; Moroder, L. (2002) The chain register in heterotrimeric collagen peptides affects triple helix stability and folding kinetics. *J. Mol. Biol*. 324, 309-318.
4) Saccà, B.; Fiori, S.; Moroder, L. (2003) Studies of the local conformational properties of the cell-adhesion domain of collagen type IV in synthetic heterotrimeric peptides. *Biochemistry* 42, 3429-3436.
5) Barth, D.; Musiol, H.-J.; Schütt, M.; Fiori, S.; Milbradt, A. G.; Renner, C.; Moroder, L. (2003) The role of cystine knots in collagen folding and stability. I. Conformational properties of $(Pro\text{-}Hyp\text{-}Gly)_5$ and $(Pro\text{-}(4S)\text{-}FPro\text{-}Gly)_5$ model trimers with an artificial cystine knot. *Chem. Eur. J.* 9, 3692-3702.
6) Barth, D.; Kyrieleis, O.; Frank, S.; Renner, C.; Moroder, L. (2003) The role of cystine knots in collagen folding and stability. II. Conformational properties of $(Pro\text{-}Hyp\text{-}Gly)_n$ model trimers with N- and C-terminal collagen type III cystine knots. *Chem. Eur. J.* 9, 3703-3714.
4) Reviewed in Renner, C.; Saccà, B.; Moroder, L. (2004) Synthetic heterotrimeric collagen peptides as mimics of cell adhesion sites of the basement membrane. *Biopolymers (Peptide Science)* 76, 34-47


***Peptide and protein engineering with non-natural amino acids*:** Synthesis of non-natural amino acids and bioincorporation to produce isomorphous protein variants, atomic mutations and spectroscopic probes: seleno- and telluromethionine, selenocysteine, thioproline, β-selenolo[3,2-b]pyrrolylalanine, amino-tryptophan, fluoroproline and various other fluoro-amino acids.


1) Karnbrock, W.; Weyher, E.; Budisa, N.; Huber, R.; Moroder, L. (1996) A new efficient synthesis of acetyl-telluro- and acetyl-selenomethionine and their use in the biosynthesis of heavy-atom protein analogs. *J. Amer. Chem. Soc*. **118**, 913-914.
2) Renner, C.; Alefelder, S.; Bae, J. H.; Budisa, N.; Huber, R.; Moroder, L. (2001) Fluoro-prolines as tools for protein design and engineering. *Angew. Chem. Int. Ed*. 40, 923-925.
3) Budisa, N.; Rubini, M.; Bae, J. H.; Weyher, E.; Wenger, W.; Golbick, R.; Huber, R.; Moroder, L. (2002) Global replacement of tryptophan with aminotryptophans generates non-invasive protein-based optical pH sensors. *Angew. Chem. Int. Ed*. 41, 4066-4069.
4) Wolschner, C.; Giese, G.; Kretzschmar, H.; Huber, R.; Moroder, L.; Budisa, N. (2009) Design of anti- and pro-aggregation variants to assess the effects of methionine oxidation in prion protein. *Proc. Natl. Acad. Sci. USA*, **106**, 7756-7761; DOI: 10.1073/pnas.0902688106.


***Proteinase inhibitors*:** Epoxysuccinyl-based inhibitors for cysteine proteases; structure-based design of mono- and bivalent inhibitors for β-tryptase and proteasome; inhibitors of serine proteases (factor Xa, uPA) and aspartyl proteases (Bace).


1) Loidl, G.; Groll, M.; Musiol, H.-J.; Huber, R.; Moroder, L. (1999) Bivalency as a principle for proteasome inhibition. *Proc. Natl. Acad. Sci. USA* **96**, 5418-5422.
2) Sperl., S.; Jacob, U.; Arroyo de Prada, N.; Stürzebecher, J.; Wilhelm, O. G.; Bode, W.; Magdolen, V.; Huber, R.; Moroder, L. (2000) (4-Amino)phenylguanidine derivatives as non-peptidic highly selective inhibitors of human urokinase. X-ray

crystal structure of an uPA/inhibitor complex at 1.8 Å resolution. *Proc. Natl. Acad. Sci. USA* **97**, 5113-5118.
3) Schaschke, N.; Matschiner, G.; Zettl, F.; Marquaerdt, U.; Bergner, A.; Bode, W.; Sommerhoff, C. P.; Moroder, L. (2001) Bivalent inhibition of β-tryptase. *Chemistry & Biology* **8**, 313-327.
4) Kaiser, M.; Groll, M.; Renner, C.; Huber, R.; Moroder, L. (2002) The core structure of TMC-95A is a promising lead for reversible proteasome inhibition. *Angew. Chem. Int. Ed*. **41**, 780-783.
5) Groll, M.; Götz, M.; Kaiser, M.; Weyher, E.; Moroder, L. (2006) TMC-95 based inhibitor design provides evidence for the catalytic versatility of the proteasome. *Chem. Biol.*, **13**, 607-614.

***Photomodulation of conformational and biological properties*:** Azobenzene peptides: conformation, redox activities, bioactivities, photomodulation of ultrafast conformational transitions in cyclic peptides, β-hairpin and triple-helical peptides as models for protein folding and unfolding events. Photoresponsive dendrimers and polymers as molecular opto-mechanical systems.

1) Behrendt, R.; Renner, C.; Schenk, M.; Wang, F.; Wachtveitl, J.; Oesterhelt, D.; Moroder, L. (1999) Photomodulation of conformational states of cyclic peptides with a backbone-azobenzene moiety. *Angew. Chem. Int. Ed. Engl*. **38**, 2771-2774.
2) Cattani-Scholz, A.; Renner, C.; Cabrele, C.; Behrendt, R.; Oesterhelt, D.; Moroder, L. (2002) Photoresponsive cyclic bis-cysteinyl-peptides as catalysts of oxidative protein folding. *Angew. Chem. Int. Ed*. **41**, 289-292.
3) Spörlein, S.; Carstens, H.; Satzger, H.; Renner, C.; Behrendt, R.; Moroder, L.; Tavan, P.; Zinth, W.; Wachtveitl, J. (2002) Ultrafast spectroscopy reveals subnanosecond peptide conformational dynamics and validates molecular dynamics simulation. *Proc. Natl. Acad. Sci. USA* **99**, 7998-8002.
4) Hugel, T.; Holland, N. B.; Cattani, A.; Moroder, L.; Seitz, M.; Gaub, H. E. (2002) Single-molecule optomechanical cycle. *Science* **296**, 1103-1106.
5) Bredenbeck, J.; Helbing, J.; Sieg, A.; Schrader, T.; Zinth, W.; Wachtveitl, J.; Renner, C.; Behrendt, R.; Moroder, L.; Hamm, P. (2003) Picosecond conformational transition and equilibration of a cyclic peptide. *Proc. Natl. Acad. Sci. USA* **100**, 6452-6457.
6) Dong, S.-L.; Löweneck, M.; Schrader, T. E.; Schreier, W.; Zinth, W.; Moroder, L.; Renner, C. (2006) A photo-controlled -hairpin peptide. *Chem. Eur. J*. **12**, 1114-1120.
7) Kusebauch, U.; Cadamuro, S. A.; Musiol, H.-J.; Lenz, M. O.; Wachtveitl, J.; Moroder, L.; Renner, C. (2006) Photo-Controlled Folding and Unfolding of a Collagen Triple Helix. *Angew. Chem. Int. Ed.* 45, 7015-7018; *Angew. Chem.* 118, 7170-7173.
8) Reviewed in Renner, C; Moroder, L. (2006) Azobenzene as conformational switch in model peptides. *ChemBioChem*, 7, 868-878.
9) Deeg, A. A.; Rampp, M. S.; Popp, A.; Pilles, B. M.; Schrader, T. E.; Moroder, L.; Hauser, K.; Zinth, W. (2014) Isomerization- and temperature-jump-induced dynamics of photoswitchable β-hairpin. *Chem. Eur. J*. **20**, 694-703.
10) Lorenz, L.; Kusebauch, U.; Moroder, L.; Wachtveitl, J. (2016) Temperature- and Photocontrolled Unfolding/Folding of a Triple-Helical Azobenzene-Stapled Collagen Peptide Monitored by Infrared Spectroscopy. *ChemPhysChem* **17**, 1314-1320