

## Curriculum Vitae · Table of Contents

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## Curriculum Vitae

Axel Blau, 38 years



### Professional Objectives

To contribute to the advancement and innovation in basic and applied research in a transdisciplinary research environment where my educational background and professional experience will help in synergistically bringing together and develop interdisciplinary expertise.

To stage research as a successful and rewarding multi-faceted and team-oriented experience of exploration, discovery, design, communication, continuous learning, and teaching on an international level.

### Research Interests

Biohybrid neuroelectronic devices based on *in vitro* models interfaced to state of the art electrophysiology equipment (patch clamping, microelectrode arrays, optical recording): Investigation of information processing in natural neural networks originating from primary sources or progenitor cell lines.

Fundamental questions focus on the deciphering and understanding of neural coding schemes on different levels: synaptic, cellular, network, and system level. Investigation of circuit dynamics underlying learning, memory retrieval, body control, and consciousness.

Application oriented research focuses on exploiting natural neural networks in biosensing, pharma screening, and robotic control.

## Current Research Focus

- Comparative MEA-based electrophysiology on natural neural *in vitro* networks from rat and chicken to study the neural mechanisms of information processing, memory formation and memory retrieval (towards pattern recognition by neural networks)
- Functional characterization of retinal pigments and *in vitro* development (towards biohybrid eyes and visual processing in robotic control)
- Neural networks in biosensing and drug-screening applications (to exploit evolutionary optimized detection mechanisms)
- Generation of biochemically and topologically textured substrates (to support neural cell adhesion, differentiation and guided interconnectivity)
- Design of semi-automatic long-term cell culturing perfusion chambers (for more homogeneous, more reproducible physiological conditions and hassle-free cell culturing)
- Development of robust culturing and freezing protocols of neural progenitor cells (as self-replenishing pools for generating a more defined and reproducible network composition)
- Development of tissue-analog 2 1/2 D cell culturing strategies (for increasing the number of computational neural entities and a more tissue-like topology)
- Development of high-resolution opto-electronic recording devices (to complement electrode-based recording approaches)
- Design of low-cost polymeric microelectrode arrays for *in vitro* electrophysiological studies
- Physico-chemical investigation of dew formation and wetting of interfaces
- Testing of CMOS-based high-density microelectrode arrays (in cooperation with ETH Zurich)

## Education

- 01.1996  
- 08.1999     **Doctoral dissertation** (*magna cum laude*) with Prof. Wolfgang Göpel at the Dept. of Physical Chemistry at the University of Tübingen, Germany. Thesis title: *Bioelectrical neural networks: Towards chemical analysis by coupling neurobiological entities to capacitive or capacitive-optical transducers.*
- 04.1997     **Trainee** under Prof. Guenter Gross at the Center for Network Neuroscience, University of North Texas, USA: *Neuronal cell culturing and recording techniques.*
- 12.1995     **Diploma** (master of science) in Chemistry, University of Tübingen, Germany. Thesis title: *Modification and characterization of microelectrode arrays for optimizing capacitive communication with nerve fibers.*
- 08.1990  
- 08.1991     **Exchange student** on a Fulbright travel fellowship at the Dept. of Chemistry, University of Miami, USA.
- 10.1989     **Pre-diploma** (bachelor of science) in Chemistry, University of Tübingen, Germany.
- 06.1986     **Abitur** (high school diploma), Aloisiuskolleg, Bonn Bad-Godesberg, Germany.

## Career Development

- 10.2002  
to present      **Juniorprofessor** (assistant professor) for *Natural Neural Networks in Biosensing and Information Processing* at the Dept. of Physics and Biophysics at the University of Kaiserslautern, Germany. Positive intermediate evaluation in 10.2005.
- 10.2001  
- 09.2002      **Principal investigator** on *neural electrophysiology* in the group of Prof. Christiane Ziegler at the Dept. of Physics at the University of Kaiserslautern, Germany.
- 09.1999  
- 09.2001      **Postdoctoral scholar** in a joint appointment with Prof. Jerome Pine, Prof. Scott Fraser, and Dr. Steve Potter at the Dept. of Biology at the California Institute of Technology, USA. Research focused on *high-speed imaging techniques with potential-sensitive fluorescent dyes for recording network activity in cultured neural networks*.
- 01.1996  
- 08.1999      **Graduate research assistant** in the group of Prof. Wolfgang Göpel at the Dept. of Physical Chemistry, University of Tübingen, Germany, focusing on the *development of a biohybrid sensing device based on neuronal networks cultured on multi-electrode arrays*.
- 10.1996  
- 07.1999      **Graduate teaching assistant** at the Dept. of Physical Chemistry, University of Tübingen, Germany.
- 08.1990  
- 08.1991      **Graduate teaching assistant** at the Dept. of Chemistry, University of Miami, USA.

## Management

*INPRO: Information Processing by Natural Neural Networks.* In this successfully finalized and positively evaluated project a CMOS-microelectrode platform with 128 electrodes and integrated microfluidics for the study of information processing in and pattern recognition by natural neural networks was developed. Total project volume: €1.8 Mio (FP5: IST-2000-26463) (2001-2005)

## Project Proposals and Funding

*BIOPS: Bioelectronic Integrated Pharmscreening Platform,* EU FP6-2002-IST-C: Future and Emerging Technologies - Open domain, ETH Zurich (coordinator), University of Kaiserslautern, Rijksuniversiteit Groningen, Fraunhofer Center at Chalmers, Ayanda Biosystems, Merck KGaA; main proposal has passed all thresholds and is in the final evaluation phase. (11.2005)

*ITNT: Information Technology in Neural Tissue;* EU FP6-2002-IST-C: Future and Emerging Technologies - Open domain, TU Munich (coordinator), University of Genoa, EPF Lausanne, INSERM France, University of Kaiserslautern, Telecom Italia, Xiwrite Italia; main proposal has passed all thresholds and is in the final evaluation phase. (09.2005 & 04.2006)

- €1,500     *Support for Promoting European and International Cooperation.* University of Kaiserslautern (03.2006)
- €4,000     *Distance Education Programme at the University of Kaiserslautern* (05.2005)
- €1,800     *Support for Promoting European and International Cooperation.* University of Kaiserslautern (04.2005)
- €5,300     *START•UP: Student Training in Advanced Robotic Technology and Unassisted neural culturing Protocols,* TU Kaiserslautern and DIBE Genoa, *EU NEURO-IT Network - Promotion of 'start-up' measures* (12.2004)
- €83,000     *Juniorprofessorship,* University of Kaiserslautern (10.2002)

## Theses

- 08.1999 **PhD** *Bioelectrical Neural networks: Towards chemical analysis by coupling neurobiological entities to capacitive or capacitive-optical transducers*. Shaker Verlag, Aachen, ISBN 3-8265-6523-1, pp. 170
- 12.1995 **Diploma** *Modification und Characterization of Microelectrode Arrays for Optimizing Capacitive Communication with Nerve Fibers*, University of Tübingen, pp.68 (German language)

## Publications (published and pending)

- 17 **Blau, A.**, Ugniwenko, T., and Ziegler, C., *Replica-molded poly(dimethylsiloxane) cell culturing lids stabilize osmolarity in neural cell cultures*. To be submitted to Journal of Neuroscience Methods (2006)
- 16 **Blau, A.**, Koster, S., Kraus, T., Wolff, S., Rooij, N. d., and Ziegler, C. *Dot matrix print head as a peristaltic pump for microfluidics*. To be submitted to Microfluidics and Nanofluidics (2006)
- 15 S. Hafizovic, F. Heer, T. Ugniwenko, **A. Blau**, C. Ziegler, and A. Hierlemann *System Integration of a CMOS-based Microelectrode Array for Interaction with Neuronal Cultures*. Submitted to Journal of Neuroscience Methods (2006)
- 14 F. Heer, S. Hafizovic, W. Franks, T. Ugniwenko, C. Ziegler, **A. Blau**, A. Hierlemann *Single-Chip Microelectronic System to Interface with Living Cells*. Submitted to Biosensors & Bioelectronics (2006)
- 13 Heer, F., Hafizovic, S., Franks, W., **Blau, A.**, Ziegler, C., and Hierlemann, A. *CMOS Microelectrode Array for Bidirectional Interaction With Neuronal Networks*. IEEE Journal of Solid State Circuits 41, 1620-1629 (2006)
- 12 **Blau, A.**, Ugniwenko, T., and Ziegler, C. *Replica-molded poly(dimethylsiloxane) cell culturing lids contribute to cell culture longevity*. Proceedings of the 5th international Meeting on Substrate-Integrated Micro Electrode Arrays, July 4-7, 2006, Reutlingen, Germany, 218-210 (2006)
- 11 Ugniwenko, T., Ziegler, C., and **Blau, A.** *Comparative multielectrode recording studies on retinal development in the chick*, Proceedings of the 5th international Meeting on Substrate-Integrated Micro Electrode Arrays, July 4-7, 2006, Reutlingen, Germany, 101-102 (2006)

- 10 F. Heer, S. Hafizovic, W. Franks, U. Frey, F. Greve, **A. Blau**, T. Ugniwenko, C. Ziegler, and A. Hierlemann *CMOS Integrated Bidirectional 128-Electrode Array for Electrogenic Cells*. Proceedings of the 5th international Meeting on Substrate-Integrated Micro Electrode Arrays, July 4-7, 2006, Reutlingen, Germany, 212-213 (2006)
- 9 **Blau, A.**, *Interaction between biological and non-biological devices*. Distance Education Programme in Nano-Biotechnology (University of Kaiserslautern), pp. 155 (2005)
- 8 F. Heer, W. Franks, **A. Blau**, S. Taschini, C. Ziegler, A. Hierlemann, H. Baltes, *CMOS Microelectrode array for the monitoring of electrogenic cells*, Biosensors & Bioelectronics 20 (2):358-66 (2004)
- 7 Potter, S. M., Demarse, T. B., **Blau, A. W.**, Wagenaar, D. A. *Multi-photon time-lapse microscopy and optical recording to study neural processing and plasticity*. Microscopy and Microanalysis 9 (S02): 184-185 (2003)
- 6 **Blau, A.**, Weini, C., Mack, J., Kienle, S., Jung, G. and Ziegler, C., *Promotion of neural cell adhesion by electrochemically generated and functionalized polymer films*. Journal of Neuroscience Methods 112 (1): 65-73 (2001)
- 5 **Blau, A.** and Ziegler, C., *Prototype of a novel autonomous perfusion chamber for long-term culturing and in-situ investigation of various cell types*. Journal of Biochemical and Biophysical Methods 50 (1): 15-27 (2001)
- 4 DeMarse, T. B., Wagenaar, D. A., **Blau, A. W.** and Potter, S. M., *The Neurally Controlled Animat: Biological Brains Acting with Simulated Bodies*. Autonomous Robots 11: 305-310 (2001)
- 3 DeMarse, T.B., Wagenaar, D.A., **Blau, A. W.** and Potter, S. M., *Interfacing neuronal cultures to a computer generated virtual world*. Proceedings of the 7<sup>th</sup> Joint Symposium on Neural Computation, USC, 10: 36-42 (2000)
- 2 **Blau, A.**, DeMarse, T., Pine, J., Potter, S., *High-speed Imaging of Neuronal Network Activity*. Proceedings of the 7<sup>th</sup> Joint Symposium on Neural Computation, 10: 9-11 (2000)
- 1 **Blau, A.**, Ziegler, Ch., Heyer, M., Endres, F., Schwitzgebel, G., Matthies, T., Stieglitz, T., Meyer, J.-U. and Göpel, W., *Characterization and Optimization of Microelectrode Arrays for in-vivo Nerve Signal Recording and Stimulation*. Biosensors & Bioelectronics 12 (9-10): 883-892 (1997)

## Book

- 1 Blau, A. *Bioelectrical Neural networks: Towards chemical analysis by coupling neurobiological entities to capacitive or capacitive-optical transducers* (Shaker Verlag, Aachen), pp. 170 (1999)

## Scientific Presentations

Bold numbers (currently 13) indicate invited talks

- 27 *The biophysics of biohybrid computers*. „Physics Olympics”, University of Kaiserslautern, Germany, May 24, 2006
- 26 *Biological neural networks: computers of tomorrow?* University of Erlangen, December 6, 2005 (invited talk)
- 25 *Progress and Expectations in Biomedical Nanoscience and -technology · A German Perspective*, Nanotechnology in Medicine and Bioengineering · Research in Germany and Sweden in a European Context for Welfare and Growth, Rostock, November 22, 2005 (invited talk)
- 24 *Aspects of Biohybrid Information Processing Devices: Towards Pattern Recognition by Natural Neural Networks*, Hanse Institute for Advanced Study, Delmenhorst, Germany, July 1, 2005 (invited talk)
- 23 *Aspects of biohybrid information processing systems*, workgroup seminar, University of Kaiserslautern, Germany, May 13, 2005 (invited talk)
- 22 *Rather nervous! Innovative computers made of silicon and biology*. „Physics Olympics”, University of Kaiserslautern, Germany, May 5, 2005
- 21 *Strategies for coupling neurons to technical substrates in biohybrid sensor systems*, AK Plasma spring meeting, Mainz, Germany, April 19, 2005 (invited talk)
- 20 *Biohybrid computational devices for pattern recognition and biosensing applications*, Applications of NanoBiotechnologies to the development of biochemical sensors and biochips for exposure assessment to chemicals, International Workshop, EC Joint Research Centre, Ispra, Italy, December 7, 2004 (invited talk)
- 19 *Neuronal Activity - Challenges in Data Analysis*, ITWM workshop, University of Kaiserslautern, Germany, November 11, 2004

- 18 *Biofilm formation on natural and artificial surfaces*, 334th Heraeus Workshop on biofunctionalized surfaces, Tutzing, Germany, October 8, 2004 (invited talk)
- 17 *What is happening in our brains while thinking and understanding?* „University for Kids“, University of Kaiserslautern, Germany, July 7, 2003
- 16 *The INPRO Project: A New Platform for Studying Information Processing by Natural Neural Networks*, MEA Meeting 2004, NMI Reutlingen, Germany, July 7, 2004 (invited talk)
- 15 *Towards Pattern Recognition with Natural Neural Networks on Biohybrid CMOS Devices*, “laser seminar”, University of Kaiserslautern, Germany, July 2, 2004 (invited talk)
- 14 *Towards information processing by natural neural networks*, Second European School on Neuroengineering "Massimo Grattarola", Genoa, Italy, June 11, 2004 (invited talk)
- 13 *Future computers: Synthesis of technology and biology?* „Physics Olympics“, University of Kaiserslautern, Germany, May 19, 2004
- 12 *Biophysical basis of biohybrid information processing devices*, high school orientation days, Wilhelm-Hofmann Gymnasium, Sankt Goarshausen, Germany, November 6, 2003
- 11 *Information processing with natural neural networks*, biology colloquium, University of Kaiserslautern, Germany, November 3, 2003 (invited talk)
- 10 *Information processing with natural neural networks*, lecture series of the physics student organization, University of Kaiserslautern, Germany, July 30, 2003
- 9 *Alfred Nobel's heritage – Background information on the Nobel prize and its benefactor*, interdisciplinary seminar, University of Kaiserslautern, Germany, November 7, 2002
- 8 *Will neural cultures learn in virtual worlds?*, biology seminar series, University of Kaiserslautern, Germany, May 28, 2002 (invited talk)
- 7 *Natural neural networks*, University of Kaiserslautern, Germany, December 17, 2001
- 6 *Spying on neural nets*, “Day of Physics”, University of Kaiserslautern, Germany, December 1, 2001
- 5 *The ANIMAT project - Neuronal cultures are learning in virtual worlds*, physics seminar, University of Kaiserslautern, Germany, September 26, 2000 (invited talk)

- 4 [Optical Signal Recording from Neuronal Networks in vitro - Detection of network activity with fast-response voltage-sensitive dyes](#), „Neurodinner“, California Institute of Technology, USA, March 20, 2000
- 3 [Chemical analysis with neuronal networks](#), PC group seminar, University of Tübingen, Germany, April 20, 1999
- 2 [Surface modification of transducer substrates to promote local cell adhesion](#), Scientific and Medical Institute, Reutlingen, Germany, February 12, 1996
- 1 [Optimization of given electrode designs for signal recording and nerve stimulation in neural prostheses](#), INTER Meeting, University of Tübingen, Germany, November 15, 1995

### Conference Contributions (past and pending)

- 25 **Blau, A.**, Ugniwenko, T., Schwender, N., and Ziegler, C. [Induction and analysis of cell adhesion and differentiation on micropatterned substrates](#), AOFA 14, Kaiserslautern, September 17-20, 2006.
- 24 Ugniwenko, T., Ziegler, C., and **Blau, A.** [Multielectrode monitoring of developmental features in the chick retina](#), 5th Forum of European Neuroscience, Vienna, July 8-12, 2006.
- 23 **Blau, A.**, Ugniwenko, T., and Ziegler, C. [Osmolarity control in neural cell culture by gas-permeable but vapor-impermeable PDMS lids](#), 5th Forum of European Neuroscience, Vienna, July 8-12, 2006.
- 22 Ugniwenko, T., Ziegler, C., and **Blau, A.** [Comparative multielectrode recording studies on retinal development in the chick](#), 5th International Meeting on Substrate-Integrated Micro-Electrode Arrays, Reutlingen, July 4-7, 2006.
- 21 **Blau, A.**, Ugniwenko, T., and Ziegler, C. [Replica-molded poly\(dimethylsiloxane\) cell culturing lids contribute to cell culture longevity](#), 5th International Meeting on Substrate-Integrated Micro-Electrode Arrays, Reutlingen, July 4-7, 2006.
- 20 F. Heer, S. Hafizovic, W. Franks, U. Frey, F. Greve, **A. Blau**, T. Ugniwenko, C. Ziegler, and A. Hierlemann [CMOS Integrated Bidirectional 128-Electrode Array for Electrogenic Cells](#). 5th International Meeting on Substrate-Integrated Micro-Electrode Arrays, Reutlingen, July 4-7, 2006.
- 19 Heer, F., Hafizovic, S., Franks, W., Ugniwenko, T., **Blau, A.**, Ziegler, C., and Hierlemann, A. [CMOS microelectrode array for bidirectional interaction with neuronal networks](#), ESSCIRC, Grenoble France, September 11-16, 2005.

- 18 Heer, F., Hafizovic, S., Franks, W., Ugniwenko, T., **Blau, A.**, Ziegler, C., and Hierlemann, A. *Fully integrated 128-electrode CMOS chip for bidirectional interaction with electrogenic cells*, Eurosensors, Barcelona, September 11-14, 2005.
- 17 Baltes, H., **Blau, A.**, Bonifazi, P., Brander, K., Dubochet, O., Franks, W., Greve, F., Hafizovic, S., Heer, F., Hessler, T., Hierlemann, A., Kochte-Clemens, B., Koster, S., Krauss, T., Linder, V., Leister, C., Rooij, N. F. d., Ruaro, E., Torre, V., and Ziegler, C. *A new platform to study information processing in natural neural networks* Poster colloquium of the Forum Medicine, Science and Technology, University of Kaiserslautern, Germany, November 22, 2004.
- 16 Baltes, H., **Blau, A.**, Bonifazi, P., Brander, K., Dubochet, O., Franks, W., Greve, F., Hafizovic, S., Heer, F., Hessler, T., Hierlemann, A., Kochte-Clemens, B., Koster, S., Krauss, T., Linder, V., Leister, C., Rooij, N. F. d., Ruaro, E., Torre, V., and Ziegler, C. *Prototype of a novel multielectrode recording and stimulation CMOS device for studying information processing in natural neural networks in vitro*, 4th Forum of European Neuroscience, Lisbon, Portugal, July 10-14, 2004.
- 15 Baltes, H., **Blau, A.**, Bonifazi, P., Brander, K., Dubochet, O., Franks, W., Greve, F., Hafizovic, S., Heer, F., Hessler, T., Hierlemann, A., Kochte-Clemens, B., Koster, S., Krauss, T., Linder, V., Leister, C., Rooij, N. F. d., Ruaro, E., Torre, V., and Ziegler, C. *A New Platform for Studying Information Processing by Natural Neural Networks*, MEA Meeting 2004, Reutlingen, Germany, July 7, 2004, Technical Program p. 20.
- 14 Heer, F., Franks, W., **Blau, A.**, Hafizovic, S., Greve, F., Taschini, S., Ziegler, C., Hierlemann, A., and Baltes, H. *CMOS Microchip for recording and stimulation of electrogenic cells*, MEA meeting 2004, Reutlingen, Germany, July 7, 2004, Technical Program p. 60.
- 13 **Blau, A.**, Franks, W., Hartleb, W., Kochte-Clemens, B., and Ziegler, C. *Patterned neural cell adhesion on artificial substrates and platinum electrodes*, 103. Hauptversammlung der Deutschen Bunsen-Gesellschaft für Physikalische Chemie e. V., Dresden, Germany, May 20-22, 2004.
- 12 Heer, F., Hafizovic, S., Franks, W., **Blau, A.**, Ziegler, C., Taschini, S., Hierlemann, A., and Baltes, H. *CMOS Neurochip for Stimulation and Recording of Electrogenic Cells*, Biosurf V - Functional Polymeric Surfaces in Biotechnology, Zurich, Switzerland, September 25-26, 2003.
- 11 Prantl, D., Mondon, M., **Blau, A.**, Franks, W., and Ziegler, C. *SFM – a versatile tool for characterizing electrodes and coatings for multi electrode arrays (MEA)*, Scanning Probe Microscopies and Organic Materials XII, Mainz, Germany, September 24-26, 2003.
- 10 Hellwig, P., **Blau, A. W.**, and Ziegler, C. M. *Prototype of a 60-Channel Amplifier Testbed with Modular Stimulation and Filtering Units*, SIMEA2003, Denton, Texas, USA, March 6, 2003.

- 9 **Blau, A. W.**, Barajas, A. V., DeMarse, T. B., Wagenaar, D., and Potter, S. M. *Spectroscopic screening approach for characterizing the response behavior of voltage-sensitive dyes in vitro*, Neuroscience Conference, San Diego, USA, November 13, 2001.
- 8 DeMarse, T. B., Wagenaar, D. A., **Blau, A. W.**, and S. M. Potter. *Enhancement and depression of neural activity over days following tetanic stimulation on a multi-electrode array*, Neuroscience Conference, San Diego, USA, November 12, 2001.
- 7 DeMarse, T. B., Wagenaar, D. A., **Blau, A. W.**, and Potter, S. M. *Neurally controlled computer-simulated animals: A new tool for studying learning and memory in vitro*, Neuroscience Conference, New Orleans USA, November 7, 2000.
- 6 DeMarse, T., Wagenaar, D., **Blau, A.**, and Potter, S. *The Animat Project: Biological brains acting with simulated bodies*, NASA Workshop on Biomorphic Robotics, Pasadena, USA, August 14-16, 2000.
- 5 DeMarse, T., Wagenaar, D., **Blau, A.**, and Potter, S. *The Animat Project: Interfacing neuronal cultures to a computer-generated virtual world*, 2nd International Meeting on Substrate-Integrated Microelectrode Arrays, Reutlingen, Germany, June 21-23, 2000.
- 4 **Blau, A.**, DeMarse, T., Wagenaar, D., and Potter, S. *System for high-speed imaging of neural network activity - Towards tracing network activity optically with fast-response voltage-sensitive dyes*, 2nd International Meeting on Substrate-Integrated Microelectrode Arrays, Reutlingen Germany, June 21-23, 2000.
- 3 **Blau, A.**, DeMarse, T., Wagenaar, D., and Potter, S. *High-speed imaging of neuronal network activity*, 7th Symposium on Neural Computation, USC, Los Angeles, May 20, 2000.
- 2 **Blau, A.**, Ziegler, C., and Göpel, W. *Cultured neural networks as prospective biosensors*, Bioregio Symposium, Tübingen, June 15, 1998.
- 1 **Blau, A.**, Ziegler, C., Heyer, M., Endres, F., Schwitzgebel, G., Matthies, T., Stieglitz, T., Meyer, J.-U., and Göpel, W. *Characterization and Optimization of Microelectrode Arrays for in-vivo Nerve Signal Recording and Stimulation*, 4th World Congress on Biosensors, Bangkok, Thailand, May 1996.

## Teaching Activities

Legend: WT: winter term, ST: summer term, HPW: hours per week

from WT 06/07	Lecture and exercises on „ <i>Experimental physics I &amp; II for biology and chemistry students</i> “ (2+1 HPW) (adapted to bachelor degree program)
WT 04/05 - ST 06	Lecture and exercises on „ <i>Experimental physics I &amp; II for biology and chemistry students</i> “ (3+2 HPW)
ST 04	Lecture on „ <i>Sensors &amp; Actuators</i> “ (3 HPW)
WT 02/03	Interdisciplinary seminar entitled „ <i>Great ideas and their parents: Nobel prizes over the past 10 years</i> “ (2 HPW)
since WT 01/02	Organization and teaching of exercises accompanying the lecture on experimental physics I & II for biology and chemistry students (2 · 2 HPW)
WT 97/98 - ST 99	Teaching assistant in physical chemistry for biochemistry students, Dept. of Chemistry, University of Tübingen
WT 96/97 & ST 97	Teaching assistant in physical chemistry for chemistry students, Dept. of Chemistry, University of Tübingen
1990 -1991	Teaching assistant in chemistry, Dept. of Chemistry, University of Miami, USA

## Supervision of Master and PhD Theses

- since 08.2006 Christine Richter, external PhD thesis: „*Biofunctionalization of polymer surfaces to control cell culture microenvironments*“, Research Center Karlsruhe and Dept. of Physics/Biophysics, University of Kaiserslautern (supervisor)
- since 10.2004 Tanja Ugniwenko, PhD thesis: „*Establishment and electrophysiological characterization of retino-cortical cultures*“, Dept. of Physics/Biophysics, University of Kaiserslautern (supervisor)
- since 01.2003 Patrick Hellwig, external PhD thesis: „*Simulation and prediction of reliability and failure of electronic components exposed to alternating environmental conditions*“, BMW, Munich, and Dept. of Physics/Biophysics, University of Kaiserslautern (supervisor)
- 11.2002 - 10.2003 David Prantl, master thesis: „*Signal processing in natural neural networks*“, Dept. of Physics, University of Kaiserslautern (co-supervisor)
- 12.2001 - 11.2002 Patrick Hellwig, master thesis: „*Prototype design of a modular 60-channel amplifier system with stimulation and filtering units*“, Dept. of Physics, University of Kaiserslautern (co-supervisor)
- 11.1998 - 05.1999 Christine Weini, master thesis: „*Optimization of cell adhesion and axonal growth on biocompatible polymers*“, Dept. of Physical Chemistry, University of Tübingen (co-supervisor)

## Course Development

- 07.2006 Practical course for the winner of the Physics Olympics at the University of Kaiserslautern on „*Osmolarity studies in cell culture perfusion systems*“ (2 weeks)
- 04.2006 Biophysical research course on „*UV/VIS spectroscopical characterization of solvatochromic and potential sensitive dyes*“ (6 weeks)
- 03.2006 Biophysical research course on „*Microfabrication of polymeric multielectrode arrays*“ (5 weeks)
- 03.2006 & 09.2005 Biophysical research course on the „Electrophysiology of neural networks generated from primary and progenitor origin“ (3 weeks)
- 09.2005 Course book and exam questions for the Distance Education Programme in Nano-Biotechnology: „*Interaction between biological and non-biological devices*“. Center for Distance Education at the University of Kaiserslautern, (p. 155)
- 03.2005 Biophysical research course on „*UV/VIS spectroscopical detection of electrochromic signals*“ (3 weeks)
- 07.2004 Practical course for high school students on „*Fluorescence microscopic characterization of cell cultures*“ (1 week)
- 04.2004 Biophysical research course on the „*Characterization and stabilization of pH and osmolarity in cell cultures*“ (3 weeks)
- 03.2004 Biophysical research course on the „*Establishment and immunocytochemical characterization of neural progenitor cells*“ (3 weeks)
- 01.2004 Practical course for high school students on „*Concepts in patterning cell adhesion mediators*“ (1 week)
- 04.2003 Biophysical research course on „*Immunocytochemical characterization of cell cultures*“ (2 weeks)
- 10.2000 - 09.2001 Internship for one high school student on „*Spectroscopic characterization of potential sensitive dyes*“ (1 year)
- 10.1996 Experimental short course on „*Electrochemical modification of electrode surfaces by electropolymerization of modified peptides for promoting nerve cell adhesion*“ during the ‘Summer School on Artificial Bioelectronic Interfaces’ at the University of Tübingen (3 days)

## Specific Skills

### Management

- Management of a European project
- Initiation of national and international project proposals
- Independent university management

### Chemical techniques

- Electrochemical metal deposition and electrochemical generation of polymer films
- Chemical vapor deposition, plasma chemistry

### Electrophysiological techniques

- Multielectrode recording from neural networks *in vitro*
- Single-cell patch-clamp recording
- Optical signal recording of neural activity with a high-speed CCD camera

### Biological techniques

- Tissue extraction, cell culturing, progenitor cell proliferation, cell freezing protocols
- Immunocytochemistry

### Spectroscopy and microscopy

- UV/vis spectroscopy, X-ray photoelectron spectroscopy (XPS)
- Cyclovoltammetry (CV), impedance spectroscopy (IS)
- Contact angle measurement
- Atomic force microscopy (AFM), fluorescence microscopy

### Clean-room and design techniques

- Photolithography
- CAM prototyping
- Circuit board design/layout and photo etching

### Computational techniques

- Virtual instrument software: Testpoint, LabVIEW
- (E)CAD software: Alibre Design, CircuitMaker
- Analysis and presentation software: Neuroexplorer, Plexon Spike Sorter, Origin, FlexPro, Mathcad, PowerPoint, Word, Excel
- Database design and programming: Access, Endnote
- Web-site design and management: NetObjects Fusion

## **Memberships**

- since
- 2006 Deutscher Hochschulverband (DHV)
- 2006 Deutsche Physikalische Gesellschaft (DPG)
- 2000 Society for Neuroscience (SfN)
- 2000 American Association for the Advancement of Science (AAAS)

## **Honors**

- 1990 Fulbright travel fellowship
- 1991

## **Panels**

- 10.2002 Member of three professorial appointment panels, University of  
to present Kaiserslautern (2002, 2005)
- Member of two "Habilitation" panels, University of Kaiserslautern (2005)
- Member of two PhD defense panels (2004, 2006)
- 11.2001 Referee for various scientific journals (Artificial Intelligence in Medicine  
to present (AIIM), Biosensors & Bioelectronics, Electrophoresis, Interface, Institute  
of Physics (IOP), Journal of Neural Engineering, Journal of  
Neuroscience Methods, Zeitschrift für Naturforschung A)
- 01.1987 Chemistry student association, University of Tübingen, Germany
- 10.1990

## Languages

German: native speaker

English: fluent

French: working knowledge

Spanish & Italian: beginner

## Personal Interests

I enjoy sailing, hang gliding, hiking, bicycling, reading, and digital photography. I am interested in philosophy, human rights, literature, art, design, jazz and classical music.

Kaiserslautern,  
August 14<sup>th</sup> 2006

