BIOGRAPHICAL SKETCH

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NAME	POSITION TITLE
Flavio Frohlich, Ph.D.	Assistant Professor
eRA COMMONS USER NAME FFROHLICH	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	YEAR(s)	FIELD OF STUDY
Imperial College London	Int. Diploma	2001	Electrical Eng.
Swiss Federal Institute of Technology, Zurich	Dipl. El.-Ing.	2003	Electrical Eng.
University of California San Diego	Ph.D.	2007	Neurobiology
Yale University	Postdoc	2008-2011	Neurobiology

A. Personal Statement

Understanding how the cortex works has remained a formidable challenge that holds the promise for a fundamental change in almost every aspect of the human condition. My long-term vision is to understand neocortical network dynamics and to develop non-invasive brain stimulation paradigms for altering and enhancing cortical function in patients with neurological and psychiatric disorders. I believe that the complexity of cortical networks requires an interdisciplinary approach that combines experimental techniques to record and manipulate neural activity with computational approaches to unravel the underlying dynamics. My interdisciplinary training that spans from electrical engineering to computational neuroscience to *in vitro* and *in vivo* neurophysiology allows me to combine these different approaches to study mechanisms and control of cortical network activity. This combination of quantitative approaches with biological measurements represents a powerful tool to address and ultimately understand the complex patterns and dynamics of cortical network activity. My overall goal as assistant professor at the University of North Carolina at Chapel Hill is to run a highly collaborative and productive laboratory that is fueled by the application and tight interaction of cutting-edge experimental and computational techniques to investigate fundamental questions on the functioning of cortical networks. My current research focuses on oscillations, a ubiquitous organization pattern of cortical activity that encompasses a broad spectrum of frequencies and is a hallmark of many physiological and pathological brain states. In particular, I combine in vivo and in vitro experiments with large-scale computational models to advance our understanding of how physiological and pathological cortical oscillations are generated, how they interact, and how they can be controlled by stimulation. It is my goal that my research will become a cornerstone of the emerging interdisciplinary field of network neuroscience.

B. Positions and Honors

Positions and Employment

2001-2002	Engineering Intern, Heidelberg Websystems, France.
2001-2003	Founder and CEO, Ingys Ltd, United Kingdom.
2003-2007	Graduate Student, Computational Neurobiology, UC San Diego, CA.
2004-2007	Graduate Research Assistant, The Salk Institute, CA.
2008-2011	Postdoctoral Research Associate, Department of Neurobiology, Yale University
May 2011-present	Assistant Professor, Departments of Psychiatry, Cell and Molecular Physiology, and Biomedical Engineering. UNC Neuroscience Center, University of North Carolina at Chapel Hill

Awards

1999-2007	Swiss Study Foundation. Elected membership for intellectually gifted students.
2003	Willi Studer Price, ETH Zurich, Award for graduating top of class.
2000-2001	UNITECH International Fellowship. One of eight Europe-wide awards to study at Imperial College.
2008-2010	Swartz Foundation Fellowship. Full fellowship for postdoctoral research.

C. Selected Publications (in chronological order)

1. **F. Frohlich** and S. Jezernik. *Annihilation of single cell neural oscillations by feedforward and feedback control.* J Comput Neurosci. 2004;17(2):165-78.
2. **F. Frohlich** and S. Jezernik. *Feedback control of Hodgkin–Huxley nerve cell dynamics.* Control Engineering Practice. 2005 Sept;13(9):1195-1206
3. **F. Frohlich**, M. Bazhenov, I. Timofeev and T.J. Sejnowski. *Maintenance and termination of neocortical oscillations by dynamic modulation of intrinsic and synaptic excitability.* Thalamus Relat Syst. 2005;3:147-156.
4. **F. Frohlich**, M. Bazhenov, I. Timofeev, M. Steriade, and T.J. Sejnowski. *Slow state transitions of sustained neural oscillations by activity-dependent modulation of intrinsic excitability.* J.Neurosci, June 7, 2006, 26(23):6153-6162.
5. **F. Frohlich** and M. Bazhenov. *Coexistence of tonic firing and bursting in cortical neurons.* Physical Review E, 2006 Sept 28; 74(3):1709-20.
6. **F. Frohlich**, M. Bazhenov, and T.J. Sejnowski. Pathological effect of homeostatic synaptic scaling on network dynamics in diseases of the cortex. J Neurosci. 2008 Feb 13;28(7):1709-20.
7. D.A. Nita DA, Y. Cissé, **F. Frohlich**, and I. Timofeev. Cortical and thalamic components of neocortical kindling-induced epileptogenesis in behaving cats. Exp Neurol. 2008 Jun;211(2):518-28.
8. M. Bazhenov, I. Timofeev, **F. Frohlich**, T.J. Sejnowski. *Cellular and network mechanisms of electrographic seizures*. Drug Discovery Today: Disease Models. 2008 Spring;5(1):45-57.
9. **F. Frohlich**, M. Bazhenov, V. Iragui-Madoz, T.J. Sejnowski. *Potassium Dynamics in the Epileptic Cortex - New Insights on an Old Topic* The Neuroscientist. 2008 Oct;14:422-433.
10. **F. Frohlich** and D.A. McCormick. *Endogenous Electric Fields May Guide Neocortical Network Activity*. Neuron. 2010 July; 67(1):129-143. Featured in E.O. Mann and O. Paulsen. *Local Field Potential Oscillations as a Cortical Soliloquy*. Neuron. 2010 July;67(1):3-5.
11. **F. Frohlich,** T.J. Sejnowski, M. Bazhenov. *Network bistability mediates spontaneous transitions between normal and pathological brain states.* J. Neurosci. 2010 Aug 11;30(32):10734-43.

D. Support

Current

(Frohlich, PI)
UNC at Chapel Hill (Start-up Funds) 5/1/2011-4/30/2014
Mechanisms and Control of Cortical Network Dynamics

We combine *in vivo* and *in vitro* physiology with computational modeling to investigate oscillatory network dynamics in neocortex. Main aim is to develop and study non-invasive electric stimulation to shape, enhance, and suppress cortical rhythms. The results of this work are expected to lead to novel non-invasive brain stimulation paradigms in patients with neurological and psychiatric disorder.
Role: PI

Past

(Frohlich, PI)
Swartz Foundation 1/1/2008-12/31/2009
Role of Endogenous Electric Fields in Shaping Network Dynamics

This project addressed the question whether the electric field generated by the brain plays an active role in shaping neocortical network dynamics. Sensitivity of the neocortical slow oscillation to different electric field waveforms was characterized. Feedback dynamics between electric field and underlying neuronal network activity was studied with a hybrid system that combined acute cortical slices with analog electronics. Computational models were used to study the mechanism of weak but global perturbations that underlie the feedback interaction between active cortical networks and the endogenous electric fields.
Role Postdoctoral Fellow (PI)