Teaching Week 5: Computational Neuroscience & Statistics, 11 - 14 October 2011
Martin Nawrot (Computational Neuroscience), Manuel Voelkle (Statistics)
Luisenstr. 56, Room 220 and Computer Pool

	Mon 10 Oct.	**Tue 11 Oct**	**Wed 12 Oct**	**Thu 13 Oct.**	**Fri 14 Oct**
Course Organizer		M. Voelkle	M. Nawrot	M. Nawrot / S. Schreiber	S. Kiebel / M. Nawrot
9.15–10.45	no lectures	**The General Linear Model I** (Correlation and Regression Analysis) - Correlation Analysis - Hypothesis Testing - Effect Sizes - Power Chapter 2, 3, 4.3., 4.4	*Lecture* Introduction to Computational Neuroscience 1: Data, Analyses, Modeling.	*Lecture* Modelling single neurons: The Hodkin-Huxley Model	
Break					
11.00–12.30	no lectures	**The General Linear Model II** (Regression Analysis "vs." ANOVA) - Multiple Regression - ANOVA - Dummy / Effects Coding - Hierarchical *F*-Test Chapter 4,8	*Lecture* Introduction to Computational Neuroscience 2: Neural Coding	*Exercises (Matlab)* Hodkin-Huxley Model	Lecture Cognitive Neuroscience I
Break					
13.30–15.00	no lectures	**Path Analysis and "Causal" Models** - Path Analysis and Path Coefficients - Direct, Indirect, Total, Zero-Order, & Spurious Effects Chapter 12	*Exercises (Matlab)* Rate Coding, Tuning Curves	*Lecture* Probabilistic modelling of spike trains: Point process theory and application (neural variability)	*Lecture* *Cognitive Neuroscience II*
Break					After last session: Multiple Choice Test, 30 questions
15.15–16.45	no lectures	**Advanced Methods** (Structural Equation Models and Multilevel Models) - Structural Equation Models - Hierarchical Linear Models Chapter 12, 14	*Exercises (Matlab)* Bayesian decoding of movement parameters from neural spike trains.	*Exercises (Matlab)* Simulation of point processes / Variability of spike trains	

Computational Neuroscience:

Keywords:
- Rate coding vs. temporal coding
- Stimulus encoding
- Stimulus association in classical conditioning
- Reward prediction
- Movement control in the motor cortex
- Bayesian decoding
- Spike trains and spike train statistics
- Stochastic point processes
- Neural variability
- Hodkin Huxley Model

Textbook:
Churchland, P.S. & Sejnowski, T.J. (1994). The Computational Brain. MIT Press, Cambridge, MA. Chapter 1, 2, 3. *(compulsory)*

Dayan, P. & Abbott, L.F. (2001). Theoretical Neuroscience. Computational and Mathematical Modeling of Neural Systems. MIT Press, Cambridge, MA. Chapters 1, 3, 5. *(recommended)*

Braitenberg V (1992) Manifesto of Brain Science. In: Information Processing in the Cortex: Experiments and Theory, A. Aertsen and VB Braitenberg, Eds., Springer, Berlin

Statistics:

Keywords:

- Correlation Analysis
- Hypothesis Testing

- Effect Sizes
- Power
- Multiple Regression
- ANOVA
- Dummy / Effects Coding
- Hierarchical *F*-Test
- Path Analysis and Path Coefficients
- Direct, Indirect, Total, Zero-Order, & Spurious Effects
- Structural Equation Models
- Hierarchical Linear Models

Textbook:

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2003). Applied multiple regression/correlation analysis for the behavioral sciences (3rd ed.). Mahwah, NJ: Erlbaum. Chapter: 2, 3, 4, 8, 12, 14