

Lubomír Košťál

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Affiliation and positions

2014 – Head of the [Department of Computational Neuroscience](#), Institute of Physiology
2013 Associated scientist at the Department of Computational Neuroscience, Institute of Physiology
2007–2012 Postdoc
2004–2007 PhD student
2004 Assistant at the Department of Neurophysiology of Memory and Computational Neuroscience, Institute of Physiology

Research interests

- Applications of information theory and estimation theory to computational neuroscience
- Metabolic cost of neuronal information and coding efficiency
- Measures of neuronal spiking variability
- Signal processing in moth olfactory system











Education



















2007 PhD, Institute of Physiology and Charles University Prague (supervisor: Prof. Petr Lansky)
2003 MSc (physics), Faculty of Mathematics and Physics, Charles University Prague

Visiting and temporal positions




Long-term stay in the lab of Prof. Jean-Pierre Rospars, INRA, Versailles, France (intermittently 2005–2009), member of the team in the projects: Barrande and ECO-NET 12644PF

Publications in journals

28. Rajdl, K. , Lansky, P. & Kostal, L. (2017) Entropy factor for randomness quantification in neuronal data. *Neural Netw.*, **95**, 57–65.
27. Levakova, M. , Tamborrino, M., Kostal, L. & Lansky, P. (2017) Accuracy of rate coding: When shorter time window and higher spontaneous activity help. *Phys. Rev. E*, **95**, 022310.
26. Levakova, M. , Tamborrino, M., Kostal, L. & Lansky, P. (2016) Presynaptic spontaneous activity enhances the accuracy of latency coding. *Neural Comput.*, **28**, 2162–2180.
25. Kostal, L.  (2016) Stimulus reference frame and neural coding precision. *J. Math. Psychol.*, **71**, 22–27.
24. Kostal, L.  & Lansky, P. (2016) Coding accuracy on the psychophysical scale. *Sci. Rep.*, **6**, 23810.
23. Kostal, L.  & Shinomoto, S. (2016) Efficient information transfer by Poisson neurons. *Math. Biosci. Eng.*, **13**, 509–520.
22. Kostal, L.  & Kobayashi, R. (2015) Optimal decoding and information transmission in Hodgkin-Huxley neurons under metabolic cost constraints. *BioSystems*, **136**, 3–10.
21. Kostal, L. , Lansky, P. & Pilarski, S. (2015) Performance breakdown in optimal stimulus decoding. *J. Neural Eng.*, **12**, 036012.
20. Kostal, L.  & Lansky, P. (2015) Coding accuracy is not fully determined by the neuronal model. *Neural Comput.*, **27**, 1051–1057.
19. Koyama, S.  & Kostal, L. (2014) The effect of interspike interval statistics on the information gain under the rate coding hypothesis. *Math. Biosci. Eng.*, **11**, 63–80.

18. Kostal, L. , Lansky, P. & Pokora, O. (2013) Measures of statistical dispersion based on Shannon and Fisher information concepts. *Inform. Sciences*, **235**, 214–223.
17. Kostal, L.  & Lansky, P. (2013) Information capacity and its approximations under metabolic cost in a simple homogeneous population of neurons. *BioSystems*, **112**, 265–275.
16. Kostal, L. , Lansky, P. & McDonnell, M. D. (2013) Metabolic cost of neuronal information in an empirical stimulus-response model. *Biol. Cybern.*, **107**, 355–365.
15. Kostal, L. & Pokora, O.  (2012) Nonparametric estimation of information-based measures of statistical dispersion. *Entropy*, **14**, 1221–1233.
14. Kostal, L.  (2012) Approximate information capacity of the perfect integrate-and-fire neuron using the temporal code. *Brain Res.*, **1434**, 136–141.
13. Kostal, L. , Lansky, P. & Pokora, O. (2011) Variability measures of positive random variables. *PLoS ONE*, **6**, e21998.
12. Kostal, L.  (2010) Information capacity in the weak-signal approximation. *Phys. Rev. E*, **82**, 026115.
11. Kostal, L.  & Marsalek, P. (2010) Neuronal jitter: can we measure the spike timing dispersion differently? *Chin. J. Physiol.*, **53**, 454–464.
10. Kostal, L. , Lansky, P. (2010) Information transfer with small-amplitude signals. *Phys. Rev. E*, **81**, 050901(R).
9. Kostal, L. , Lansky, P. (2008) Randomness of spontaneous activity and information transfer in neurons. *Physiol. Res.*, **57**, S133–S138.
8. Kostal, L., Lansky, P. & Rospars, J.-P.  (2008) Efficient olfactory coding in the pheromone receptor neuron of a moth. *PLoS Comput. Biol.*, **4**, e1000053.
7. Kostal, L. , Lansky, P. & Rospars, J.-P. (2007) Encoding of pheromone intensity by dynamic activation of pheromone receptors. *Neurocomputing*, **70**, 1759–1763.
6. Kostal, L. , Lansky, P. & Rospars, J.-P. (2007) Review: Neuronal coding and spiking randomness. *Eur. J. Neurosci.*, **26**, 2693–2701.
5. Kostal, L. , Lansky, P. (2007) Variability and randomness in stationary neuronal activity. *BioSystems*, **89**, 44–49.
4. Kostal, L. , Lansky, P. & Zucca, C. (2007) Randomness and variability of the neuronal activity described by the Ornstein-Uhlenbeck model. *Netw. Comput. Neural Syst.*, **18**, 63–75.
3. Kostal, L. , Lansky, P. (2006) Classification of stationary neuronal activity according to its information rate. *Netw. Comput. Neural Syst.*, **17**, 193–210.
2. Kostal, L. , Lansky, P. (2006) Similarity of interspike interval distributions and information gain in a stationary neuronal firing. *Biol. Cybern.*, **94**, 157–167.
1. Duchamp-Viret, P., Kostal, L., Chaput, M., Lansky, P. & Rospars, J.-P.  (2005) Patterns of spontaneous activity in single rat olfactory receptor neurons are different in normally breathing and tracheotomized animals. *J. Neurobiol.*, **65**, 97–114.

Publications in books and peer-reviewed proceedings, editorials

3. Christodoulou, C. , Kostal, L. & Büschges, A. (2017) Editorial, Special issue of *BioSystems* on Selected papers presented at the Twelveth International Workshop on Neural Coding, Cologne, Germany, 2016. *BioSystems*, **161**, 1–2.
2. Kostal, L. , Lansky, P. & Pokora, O. (2012) How regular is neuronal activity? In *ESANN 2012: The 20th European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning*. ESANN, Bruges, Belgium, pp. 495–500.
1. Kostal, L. , Lansky, P. & Rospars, J.-P. (2008) The Adaptation of the Moth Pheromone Receptor Neuron to its Natural Stimulus. In Ricciardi, L., Buonocore, A. & Pirozzi, E. (eds.), *AIP Conference Proceedings, Collective Dynamics: Topics on Competition and Cooperation in the Biosciences: A Selection of Papers in the Proceedings of the BIOCAMP2007 International Conference*. AIP, Melville, New York, pp. 147–161.

Invited talks

- 2017** Lecture at the University of Naples Federico II, Naples, Italy
- 2016** Lecture at the Institute for Stochastics, Johannes Kepler University, Linz, Austria
- 2016** *Workshop on multitrack event-trains in neural, social, seismological, and financial data*, Karuzaiwa, Japan
- 2014** *Biological and Bio-Inspired Information Theory*, Banff International Research Station, Canada
- 2014** *Mathematical Modeling and Statistical Analysis in Neuroscience*, University of Copenhagen, Denmark
- 2014** Lecture at RIKEN, Tokyo, Japan
- 2014** Lecture at the National Institute of Informatics, Tokyo, Japan
- 2013** *Matematické modely a aplikace*, Podlesí, Czech Republic
- 2013** *CNS2013 Workshop on Methods of Information Theory in Computational Neuroscience*, Paris, France
- 2013** Workshop on the *Applications of Information Theory*, Ritsumeikan University, Japan
- 2013** Lecture at the Kyoto University, Japan
- 2009** *Workshop on Sensory Neuroinformatics*, Pilsen, Czech Republic

Grants

- 2017-2018** *Neural coding in the moth olfactory sensory system*, Project MOBILITY (The Czech Republic and France), principal investigator
- 2017-2019** *Neural coding precision and its adaptation to the stimulus statistics*, The Czech Science Foundation (GACR), principal investigator
- 2017-2018** *Perturbed stochastic point processes as a novel tool for neural coding analysis*, Project MOBILITY (The Czech Republic and Austria), member of the team
- 2015-2017** *Efficiency of information transfer and the role of energetic constraints in neuronal systems*, The Czech Science Foundation (GACR), principal investigator
- 2015-2016** *Statistical inference for perturbed stochastic processes with applications to neuroscience*, Project MOBILITY (The Czech Republic and Austria), member of the team
- 2012-2013** *Information beyond Shannon*, European Office of Aerospace Research and Development, support for the Information Beyond Shannon 2013 workshop, principal investigator
- 2012-2014** *Information-theoretic analysis of stimulus coding in sensory neurons*, The Czech Science Foundation (GACR), principal investigator
- 2011-2012** *Neural Coding*, Office of Naval Research Global, support for the Neural Coding 2012 workshop, principal investigator
- 2011-2013** *The role of noise in neuronal information processing*, The Czech Science Foundation (GACR), member of the team
- 2007-2009** *Signal processing in olfactory flux detector*, Grant Agency of the Academy of Sciences of the Czech Republic, principal investigator
- 2005** *Marie-Curie fellowship at INRA*, Versailles (France)
- 2004-2008** *Principles of information processing in neurons and their application*, Project Information Society, Academy of Sciences of the Czech Republic, member of the team

Awards

- 2012** *Otto Wichterle Award* from the Academy of Sciences of the Czech Republic

Pedagogical activities

- Teaching in the post-gradual course “Progress in Neuroscience” (PhD programme Neurosciences, *Doctoral Study Programmes in Biomedicine*) and in the “Opening Course” for PhD students at the Institute of Physiology, CAS
- Supervisor of diploma thesis in the master programme *Mathematical Modelling in Physics and Technology*, Faculty of Mathematics and Physics, Charles University, Prague
- Co-supervisor in the PhD programme *Probability, Statistics and Mathematical Modelling*, Faculty of Science, Masaryk University, Brno

Professional service

■ Editorial duties

- *Neural Processing Letters*: member of the Editorial Board since 2016
- *BioSystems*: associate editor of the *Neural Coding 2016* special issue

■ External assessor

- *The French National Research Agency (ANR)*: project reviewer
- *The Agency for the Evaluation of Universities and Research Centers (ANVUR)*, France: peer reviewer
- *The National Science Centre (NCN)*, Poland: project reviewer
- *The Czech Science Foundation (GAČR)*: member of the evaluation panel *P103 Cybernetics and information processing* (2017–2019)

■ Reviewer for scientific journals and proceedings

Biological Cybernetics; BioSystems; Brain Research; Brazilian Journal of Probability and Statistics; Entropy; IEEE Journal on Selected Areas in Communications, Mathematical Biosciences and Engineering; IEEE Transactions on Molecular, Biological, and Multi-Scale Communications; IEEE Wireless Communications and Networking Conference; Journal of Neural Engineering; Journal of Theoretical Biology; Neural Computation; Neural Networks; Neural Processing Letters; Neurocomputing; Physical Review E; PLoS Computational Biology; Scientific Reports;

■ Organization of workshops and conferences

- *CNS2017: Workshop on Methods of Information Theory in Computational Neuroscience* (Antwerp, Belgium, July 19-20, 2017)
<http://lizier.me/joseph/conferences/201707-CNS2017-ITW/>
member of the organizing committee
- *CNS2016: Workshop on Methods of Information Theory in Computational Neuroscience* (Jeju, South Korea, July 6–7, 2016)
<http://lizier.me/joseph/conferences/201607-CNS2016-ITW/>
member of the organizing committee
- *CNS2015: Workshop on Methods of Information Theory in Computational Neuroscience* (Prague, July 22–23, 2015)
<http://www.biomed.cas.cz/~kostal/CNS2015-ITW>
main organizer (jointly with A. Dimitrov, M. Gastpar, T. Sharpee, S. Schultz)
- *Neural Coding 2014* (Versailles, France, October 6–10, 2014)
http://colloque.inra.fr/neural_coding_2014
member of the organising committee
- *Information beyond Shannon 2013* (Prague, July 3–4, 2013)
<http://www.biomed.cas.cz/~kostal/IBS2013>
main organizer
- *Neural Coding 2012* (Prague, September 2–7, 2012)
<http://nc2012.biomed.cas.cz>
main organizer (jointly with P. Lansky)

■ Popularization of science

Interviews for radio and TV: programmes of Czech Radio Vltava and Leonardo in 2008, 2012; radio Impuls 2012, main news programme of Czech TV in 2012 (coverage of Wichterle prize reception and Neural Coding 2012 workshop)

■ Miscellaneous

- Initiated (jointly with Dr. R. Kobayashi) the *Memorandum of Understanding* between the *Institute of Physiology of the Czech Academy of Sciences, Czech Republic* and the *National Institute of Informatics, Japan* in the area of research and education in the fields of artificial intelligence and computational neuroscience (signed by the directors in 2016)