

## *Curriculum Vitae* – Serena Bovetti

### **Current Position**

Assistant professor – Comparative Anatomy and Cytology

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### **Short description**

I earned my Ph.D. degree in Neuroscience at the University of Turin (Italy) with a thesis focusing on the molecular mechanisms regulating neuroblast migration and differentiation in the postnatal and adult rodent olfactory bulb. My doctoral training was performed in partnership with Dr. Puche's research team (University of Maryland, Baltimore, USA), a leading laboratory in the field of olfaction, where I spent 18 months (January 2005- September 2006). As a post-doctoral fellow in Dr. De Marchis' team (University of Turin, Italy) and in tight collaboration with Dr. Studer's research team (University of Sophie Antipolis, Nice, France), I pursued my interests in olfactory plasticity by unravelling the intrinsic versus extrinsic contribution to olfactory interneuron specification with a specific focus on the dopaminergic subtype. In April 2012, I moved to the Italian Institute of Technology (Genoa, Italy) where I worked until July 2017 as a post-doctoral fellow in Dr. Fellin's research team. By joining mouse genetics, *in vivo* two-photon calcium imaging and optogenetics, my project aimed to apply new all-optical approaches to study the physiology of cortical circuits in the intact mouse brain. Since June 2018 I am researcher (RTDb) at the University of Turin (Dept. of Life Sciences and Systems Biology and Neuroscience Institute Cavalieri Ottolenghi) and my scientific interests are aimed in understanding the role of olfactory circuits in reproductive behavior. In particular, we use *in vivo* two-photon functional imaging and whole-brain 3D reconstruction combined with mouse genetics, to study the reciprocal interaction between the olfactory and the GnRH system, and the involvement of dopaminergic olfactory interneurons in the processing of odors relevant for mating-related behavior.

### **Research experience**

*June 2018 – Present*

Assistant professor – Comparative Anatomy and Cytology

University of Turin, Dept. of Life Sciences and Systems Biology (DBIOS).

*April 2012 - July 2017*

Post-doctoral fellow. Dept. of Neuroscience and Brain Technologies,

Italian Institute of Technology (Genoa, Italy).

Project title: "Advanced optical technologies for the study of cortical networks". Supervisor: Dr. Tommaso Fellin.

*January 2008 - February 2012*

Post-doctoral fellow. Dept. of Animal and Human Biology, University of Turin (Italy).

Project title: “Role of sensory experience on postnatal and adult neurogenesis in the mouse olfactory bulb”.  
Supervisors: Dr. Silvia De Marchis / Dr. Aldo Fasolo.

*November 2009 and February 2010*

Short-term research activity. INSERM – CNRS University Lyon1 (France). Scientific coordinator: Dr. Anne Didier.

*January 2007 - January 2008*

Post-doctoral fellow. Dept. of Animal and Human Biology, University of Turin (Italy). Project title: “Structural and molecular organization of neurogenic niche in adult mammals brain”. Supervisor: Dr. Aldo Fasolo.

*Nov 2002 - Jan 2007*

Ph.D. fellow. Dept. of Animal and Human Biology, University of Turin (Italy). Project title: “Molecular aspects and mechanisms of cell migration and differentiation in the rodent olfactory bulb”. Supervisor: Dr. Isabelle Perroteau.

*Jan 2005 - Sept 2006*

Visiting fellow. Dept. of Anatomy and Neurobiology, University of Maryland, School of Medicine, (Baltimore, USA). Supervisor: Dr. Adam Puche.

*Jan 2002 - Jun 2002*

Post-masters fellow. Dept. of Animal and Human Biology, University of Turin (Italy). Project title: “Neuronal and glial plasticity in the olfactory bulb: role of glutamate receptors”. Supervisor: Dr. Patrizia Bovolin.

*Jan 2000 - Nov 2001*

Undergraduate trainee. Dept. of Animal and Human Biology, University of Turin (Italy). Project title: “Effect of somatostatin in the control of endozepines release from cultured rat astrocytes”. Supervisor: Dr. Aldo Fasolo, in partnership with Dr. Hubert Vaudry, INSERM U413, University of Rouen (France).

*Feb 2000 - Sept 2000*

Socrates/Erasmus visiting fellow. INSERM U413, University of Rouen (France). Supervisors: Dr. Aldo Fasolo and Dr. Hubert Vaudry.

## **Education**

- August 2017* National Academic Qualification as Associate Professor (Abilitazione scientifica nazionale, II fascia) in Comparative Anatomy and Cytology (05/B2).
- January 2007* Ph.D. in Neuroscience (Excellent). University of Turin (Italy).
- November 2001* Italian Board of Biologists Certification.
- November 2001* Master Degree in Biological Sciences (105/110). University of Turin (Italy).

## **Technical expertise**

- Mouse genetics* Breeding and use of transgenic mouse models (including knock-out models, Cre-, CreRT Inducible mouse lines, Cre-lox technology). Training certificate #008CRLI/2016 for “Personnel Responsible for Designing Procedures and

	Projects involving animals” in compliance with the requirements of Directive 63/2010/EU, relaxed by Charles River Campus.
<i>Postnatal and adult mouse surgery</i>	Stereotaxic injections of pharmacological agents, adeno-associated or lenti viral vectors for the expression of functional indicators/actuators of cell activity (including calcium indicators and excitatory and inhibitory opsins), insertion of micro-optics for deep brain imaging.
<i>Microscopy</i>	<i>In vivo</i> two-photon calcium imaging alone or in combination with one-photon optogenetics on anesthetized and awake head-restrained mice, high-speed two-photon calcium imaging with patterned illumination through the phase modulation of light, routine and high-speed calcium imaging in deep brain regions using GRIN lens-based microendoscopes, confocal microscopy (including ex-vivo time lapse confocal imaging), routine brightfield and fluorescence microscopy.
<i>Optogenetics</i>	<i>In vivo</i> expression of excitatory/inhibitory opsins, <i>in vivo</i> single and two-photon optogenetics in combination with two-photon calcium imaging.
<i>Molecular biology and biochemistry</i>	Single cell/small tissue isolation, mRNA/DNA extraction, PCR, protein isolation, Western blotting.
<i>Histology</i>	Perfusion, tissue fixation, cryostat sectioning, vibratome sectioning, routine histochemical staining, immunohistochemistry, tract tracing, in situ zymography, stereological cell counting.
<i>Olfactory behavior</i>	Olfactory enrichment, familiarization and learning.
<b>Teaching experience</b>	
<i>2019-2020</i>	Comparative Anatomy, Undergraduate Degree in Natural Sciences, University of Turin (Italy).
<i>2018-2019</i>	Comparative Anatomy, Undergraduate Degree in Natural Sciences, University of Turin (Italy).
<i>2015-2016</i>	Seminars for Graduate Doctoral School in Life and Humanoid Technologies, Course in Neuroscience and Brain Technologies (XXIX cycle) (4 hours of lessons/year), University of Genoa (Italy).
<i>2012</i>	Undergraduate Teacher Assistant in Comparative Anatomy (40 hours of lessons, ex art.33 now art.76), Undergraduate Degree in Biological Science, University of Turin (Italy).
<i>2008-2009</i>	Undergraduate Teacher Assistant in Biomaterials (20 hours of lessons/year), Undergraduate Degree in Material Science, University of Turin (Italy).

2002-2010 Seminars for Developmental Biology course, Masters Degree in Biological Science and Biotechnology, (6 hours of lessons/year). Molecular Biotechnology Centre and Dept. of Human and Animal Biology, University of Turin (Italy).

2002-2009 Seminars for Neurobiology course, Masters Degree in Biological Science (6 hours of lessons/year). Dept. of Human and Animal Biology, University of Turin (Italy).

### **Memberships**

Società Italiana di Neuroscienze.

### **Journals Referee**

Frontiers in Neurogenesis; Journal of Neuroscience Method; European Journal of Neuroscience; Brain Structure and Function; Scientific Reports.

### **Current grants**

-Starting grant BOVS\_RILO\_19\_01

Source: University of Turin Ricerca Locale 2019 – BOVETTI

Period covered: 1/01/2019 - 31/12/2019.

-Title: Boosting adult neural stem cell function to counteract aging and cognitive decline

Source: Fondazione Cassa di Risparmio di Torino

Period covered: 2020 - 2022

### **Invited talks and seminars**

- High-speed two-photon fluorescence functional imaging of cortical and subcortical regions. 65° Congresso GEI, Ancona June 24-27 2019.
- Advances and applications of two-photon microscopy in neuroscience. Workshop: Correlative microscopy. ZEISS Academy. University of Turin, November 7<sup>th</sup> 2018.
- Microscopia a due fotoni per lo studio funzionale del cervello dei mammiferi in vivo. Workshop: Le giornate delle neuroscienze. University of Turin, June 27<sup>th</sup> 2018.
- Advanced optical approaches for the functional investigation of the mammalian brain. Workshop: Imaging from basic science to clinical applications. Istituto di ricerche farmacologiche Mario Negri (Milan), February 6<sup>th</sup> 2018.
- Scanless two-photon fluorescence imaging in the intact mouse brain. National Congress of the ITALIAN NEUROSCIENCE SOCIETY. Lacco Ameno, Ischia Island (Naples) October 4<sup>th</sup> 2017.
- Advanced optical approaches for the functional investigation of the mammalian brain. Poseidon summer school, Photonics for Health. San Martino di Castrozza, June 19<sup>th</sup> 2017.
- Optogenetics and two-photon microscopy. Workshop: Emerging Technologies in Neuroscience. University of Turin, Molecular Biotechnology center. Turin, May 31<sup>st</sup> 2017.
- High-speed in vivo two-photon calcium imaging of cortical and subcortical neuronal networks. 6° Workshop Tecniche avanzate di microscopia, Neuroscience Institute Cavalieri Ottolenghi (NICO). Turin, May 30 2017.
- Two-photon microscopy for in vivo functional imaging. Seminar for the Neurobiology course, Masters Degree in Biological Science, University of Turin. December 16<sup>th</sup> 2016.
- In vivo fast imaging and optogenetic manipulation using genetically-encoded fluorescent indicators and actuators. Marie Curie ECMED Workshop, Bogliasco (Genoa), June 8<sup>th</sup> 2016.

- Optical dissection of brain circuits with patterned two-photon microscopy. Humanitas research center (Rozzano, MI), March 2<sup>nd</sup> 2016.
- Optical dissection of brain circuits with patterned two-photon microscopy. Molecular Biotechnology Center, Turin, February 25<sup>th</sup> 2016.
- Two-photon high speed imaging and optogenetic manipulation in the intact mouse brain. Seminar for the Biophysics course, Masters Degree in Biological Science, University of Turin. December 21<sup>st</sup> 2015.
- Simultaneous fast imaging and optogenetic inhibitory manipulation of neuronal networks in vivo. OPTOGEN2015 conference, Lecce, 17<sup>th</sup> December 2015.
- High-speed scanless imaging of genetically encoded functional indicators in the intact mouse brain. 66<sup>th</sup> SIF National Conference. Genoa, September 18<sup>th</sup> 2015.
- Optical probing of brain circuits with naturalistic patterns of neuronal activation. Spatially Precise Optogenetics at Depth Incubator Meeting. Washington DC (USA), December 13<sup>th</sup> 2013.
- Scanless two-photon calcium imaging at millisecond temporal resolution *in vivo*. Università Cattolica. Roma, July 19<sup>th</sup> 2013.
- Scanless two-photon calcium imaging at millisecond temporal resolution in vivo. Neuroscience Institute Cavalieri Ottolenghi (NICO). Turin, May 24<sup>th</sup> 2013.
- COUP-TFI regola il differenziamento degli interneuroni olfattivi dopaminergici derivanti dal lineage Emx1” dopaminergici derivanti dal lineage Emx1. 58°Convegno Gruppo embriologico Italiano. Turin, June 15<sup>th</sup> 2012.
- Loss of COUP-TFI function in the Emx1 lineage impairs dopaminergic differentiation in the olfactory bulb. University of Dijon. Dijon (France), May 28<sup>th</sup> 2012.
- Neurogenesis in the adult olfactory bulb: from stem cells to integrated interneurons. Workshop: Promises and Pitfalls of Stem Cell Research: An Update. Turin, November 5<sup>th</sup> 2009.
- La rottura di un dogma: quanto è plastico il sistema nervoso centrale? Giornata per l’orientamento universitario. Turin, April 23<sup>rd</sup> 2009.
- Molecular aspects and mechanisms of cell migration and maturation in the rodent olfactory bulb. Université Claude Bernard. Lyon 1 (France), June 7<sup>th</sup> 2007.

**Complete list of publications** *H index (Scopus- Elsevier): 16 (November 2019)*

**Peer-reviewed:**

- Forli A, Vecchia D, Binini N, **Bovetti S**, Moretti C, Mahn M, Baker C, Bolton ML, Yizhar O and Fellin T. “Two-photon bidirectional control and imaging of neuronal excitability with cellular resolution in vivo”. Cell Rep. 2018 Mar 13;22:3087-3098.
- Mariotti L, Losi G, Sessolo M, Melone M, Chiavegato A, Marcon I, **Bovetti S**, Forli A, Fellin F, Conti F, and Carmignoto G. “GABAergic interneuron type-specific signaling to astrocytes in neocortical circuits”. Nat Commun. 2018 Jan 8;9:82.
- Zucca S, D’Urso G, Pasquale V, Vecchia D, Pica G, **Bovetti S**, Moretti C, Varani S, Molano-Mazón M, Chiappalone M, Panzeri S, Fellin T. An inhibitory gate for state transition 1 in cortex. Elife. 2017 May 16;6. pii: e26177. doi: 10.7554/eLife.26177.
- **Bovetti S**, Moretti C, Zucca S, Dal Maschio M, Bonifazi P, Fellin T. (2017). Simultaneous high-speed imaging and optogenetic inhibition in the intact mouse brain. Sci Rep. Jan 5;7:40041. doi: 10.1038/srep40041.
- Moretti C, Antonini A, **Bovetti S**, Liberale C and Fellin T. (2016). Scanless functional imaging of hippocampal networks using patterned two-photon illumination through GRIN lenses. Biomed Opt Express. 2016 Sep 12;7:3958-3967.

- Bonzano S, **Bovetti S**, Gendusa C, Peretto P, De Marchis S. (2016). Adult born olfactory bulb dopaminergic interneurons: Molecular determinants and experience-dependent plasticity. *Front Neurosci.* 2016 May 6;10:189.
- Sessolo M, Marcon I, **Bovetti S**, Losi G, Cammarota M, Ratto GM, Fellin T, Carmignoto G. (2015). Parvalbumin-Positive Inhibitory Interneurons Oppose Propagation But Favor Generation of Focal Epileptiform Activity. *J Neurosci.* 35:9544-57.
- **Bovetti S**, Fellin T. (2015). Optical dissection of brain circuits with patterned illumination through the phase modulation of light. *J Neurosci Methods.* 15:66-77.
- Bonzano S, **Bovetti S**, Fasolo A, Peretto P, De Marchis S. (2014). Odour enrichment increases adult-born dopaminergic neurons in the mouse olfactory bulb. *Eur J Neurosci.* 40:3450-7.
- **Bovetti S**, Moretti C, Fellin T. (2014). Mapping brain circuit function in vivo using two-photon fluorescence microscopy. *Microsc Res Tech.* 77:492-501.
- **Bovetti S**, Bonzano S, Garzotto D, Giannelli SG, Iannielli A, Armentano M, Studer M, De Marchis S. (2013). COUP-TFI controls activity-dependent tyrosine hydroxylase expression in adult dopaminergic olfactory bulb interneurons. *Development.* 140:4850-9.
- Beltramo R, D'Urso G, Dal Maschio M, Farisello P, **Bovetti S**, Clovis Y, Lassi G, Tucci V, De Pietri Tonelli D, Fellin T. (2013). Layer-specific excitatory circuits differentially control recurrent network dynamics in the neocortex. *Nat Neurosci.* 16:227-34.
- Gribaudo S, **Bovetti S**, Friard O, Denorme M, Fasolo A and De Marchis S (2012). The postsynaptic protein Neurogranin is transiently expressed during maturation of olfactory tufted cells and regulated by olfactory deprivation. *J Comp Neurol.* 520:3055-69.
- **Bovetti S**, Gribaudo S, Puche AC, De Marchis S and Fasolo A (2011). From progenitors to integrated neurons: role of neurotransmitters in adult olfactory neurogenesis. Review. *Journal of Chemical Neuroanatomy* 42:304-16.
- Puche AC and **Bovetti S** (2011). Studies of adult neural stem cell migration. *Methods Mol Biol.* In Stem Cell Migration. Humana Press Inc. 750:227-40.
- **Bovetti S**, Veyrac A, Peretto P, Fasolo A, De Marchis S (2009). Olfactory enrichment influences adult neurogenesis modulating GAD67 and plasticity-related molecules expression in newborn cells of the olfactory bulb. *PLoS One* 4:e6359.
- Gribaudo S, **Bovetti S**, Garzotto D, Fasolo A, De Marchis S (2009). Expression and localization of the calmodulin-binding protein neurogranin in the adult mouse olfactory bulb. *J Comp Neurol* 517:683-94.
- Bovolin P, **Bovetti S**, Fasolo A, Katarova Z, Szabo G, Shipley MT, Margolis FL and Puche AC. (2009). Developmental regulation of metabotropic glutamate receptor 1 splice variants in olfactory bulb mitral cells. *J Neurosci Res* 87:369-79.
- **Bovetti S**, Peretto P, Fasolo A and De Marchis S (2007). Spatio-temporal specification of olfactory bulb interneurons. *Journal of Molecular Histology* 38:563-9.
- **Bovetti S**, Hsieh YC, Bovolin P, Perroteau I, Kazunori T and Puche AC (2007). Blood vessels form a migratory scaffold for migrating neuroblasts in adult olfactory bulb. *J Neurosci* 27:5976-80.
- **Bovetti S**, Bovolin P, Perroteau I, and Puche AC (2007). SVZ-derived neuroblast migration to the olfactory bulb is modulated by matrix remodeling. *Eur J Neurosci* 25: 2021–2033.
- De Marchis S, **Bovetti S**, Carletti B, Hsieh YC, Garzotto D, Peretto P, Fasolo A, Puche AC, Rossi F (2007). Generation of distinct types of periglomerular olfactory bulb interneurons during development and in adult

mice: implication for intrinsic properties of the subventricular zone progenitor population. *J Neurosci* 27:657-664.

- Zaghetto A, Paina S, Mantero S, Platonova N, Peretto P, **Bovetti S**, Puche AC, Piccolo S and Merlo GR (2007). Activation of the Wnt- $\beta$ -catenin pathway in a cell population on the surface of the forebrain is essential for the establishment of olfactory axon connections. *J Neurosci* 27:9757-68.
- **Bovetti S**, De Marchis S, Gambarotta G, Fasolo A, Perroteau I, Puche AC, Bovolin P (2006). Differential expression of neuregulins and their receptors in the olfactory bulb layers of the developing mouse. *Brain Res* 1077:37-47.
- De Marchis S, Temoney S, Erdelyi F, **Bovetti S**, Bovolin P, Szabo G and Puche AC (2004). GABAergic phenotypic differentiation of a subpopulation of subventricular derived migrating progenitors. *Eur J Neurosci* 20:1307-17.

#### **Pre-print:**

- Antonini, A., **Bovetti, S.**, Moretti, C., Succol, F., Rajamanickam, V.P., Bertoncini, A., Liberale, C, Fellin, T. (2018). Extended field-of-view ultrathin microendoscopes with built-in aberration correction for high-resolution imaging with minimal invasiveness. *BioRxiv*. doi: <https://doi.org/10.1101/504472>.

#### **Book Chapters:**

- **Bovetti S**, Moretti C and Fellin T. (2019) Patterned two-photon illumination for high-speed functional imaging of brain networks in vivo". Contributo ad invito per il volume "Advanced Optical Methods for Brain Imaging" Springer book editore.
- Puche AC and **Bovetti S** (2011). Studies of adult neural stem cell migration. *Methods Mol Biol. In Stem Cell Migration*. Humana Press Inc. 750:227-40.

#### **Proceedings:**

- Forli, A., Vecchia, D., Binini, N., **Bovetti, S.**, Moretti, C., Mahn, M., Baker, C.A., Bolton, M.M., Yizhar, O., Fellin, T. Two-photon imaging and manipulation of neural networks with high spatial resolution and minimal crosstalk. *Optics InfoBase Conference Papers Volume Part F88-BRAIN 2018, 2018, 2pOptics and the Brain, BRAIN 2018; Hollywood; United States; 3 April 2018 through 6 April 2018; Code 139858*.
- Antonini, A., **Bovetti, S.**, Moretti, C., Succol, F., Rajamanickam, V.P., Bertoncini, A., Fellin, T., Liberale, C. 3D printing of microlenses for aberration correction in GRIN microendoscopes. *Optics InfoBase Conference Papers Volume Part F82-CLEO\_Europe 2017, 2017, 1pThe European Conference on Lasers and Electro-Optics, CLEO\_Europe 2017; Munich; Germany; 25 June 2017 through 29 June 2017; Code 139018*.