CURRICULUM VITAE January 2019

IRINA BELOOZEROVA

(pronounced: *Erena Below-oh-zero-va*)

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EXPERTISE:

Organization and function of motor systems. Neuronal mechanisms and biomechanics of locomotion and posture. Control and adaptation of motor behaviors in natural environments. Function of neuronal networks during real-life unconstrained behaviors of higher mammals.

DEGREES:

1989 - Ph.D. in neuroscience - Lomonosov University in Moscow, Russia
PhD thesis: "Role of motor cortex in control of locomotion"
1981 - M.S. in physiology - Lomonosov University in Moscow, Russia
1979 - B.S. in biology - Lomonosov University in Moscow, Russia

ACADEMIC POSITIONS:

Oct. 2018 - Research Scientist II Faculty, School of Biological Sciences, Georgia Tech, Atlanta, GA
2008-Aug. 2018 - Associate Professor, Barrow Neurological Institute (BNI), Phoenix, AZ
2005-present - Adjunct Assistant/Associate Professor, Arizona State University, Tempe, AZ
2000-2008 - Assistant Staff Scientist (Assistant Professor equivalent), Barrow Neurological Institute, Phoenix, AZ, USA
1995-2000 - NIH Postdoctoral Fellow, Univ. of Connecticut, USA (with Dr. Swadlow)
1993-1995 - Postdoctoral Fellow, University of Montreal, Canada (with Dr. Rossignol)
1991-1992 - Postdoctoral Fellow, University of Bristol, UK (with Dr. Armstrong)
1989-1993 - Senior Scientist, Institute of Biomedical Problems, Moscow, Russia
1985-1989 - Research Scientist, Institute of Biomedical Problems, Moscow, Russia
1981-1985 - Junior Scientist, Institute of Biomedical Problems, Moscow, Russia
1980-1983 - Research Assistant, Institute of Problems of Information Transmission, Moscow, Russia (with Drs. Arshavsky and Orlovsky)

HONORS AND AWARDS:

2018 - Three-year NSF grant "Cortical control of locomotion".
2009 - NIH award to support students under American Recovery and Reinvestment Act.
2007 - Five-year NIH R01 grant "Forebrain control of locomotion", no cost extension till 12/01/14.
2000 - Four-year NIH R01 grant "Motor cortex and thalamo-cortical network in locomotion".
1996 - Three-year NIH National Research Service Award, "Subpopulations of motor cortical neurons in locomotion".
1994 - Two-year grant from Fonds de la Recherche en Sante du Quebec, Canada, "Antidromic activity of dorsal root filaments".
1991 - One-year fellowship, The Royal Physiological Society, UK.
1985 - Third Prize from the Exhibition of National Economic Achievements, USSR.

PROFESSIONAL SOCIETIES:

Regular member of: Society for Neuroscience
American Physiological Society
Society for the Neural Control of Movements

PUBLICATIONS: 58 full size research papers in referred journals and **10** reviews/book chapters:

Research reports (Full size, Peer-reviewed)

* High school student
** Undergraduate student
*** Graduate student
**** Medical resident

1. Zubair HN**, Stout EE***, Dounskaia N, **Beloozerova IN**. The role of inter-segmental dynamics in control of the forelimb joints during unperturbed and perturbed locomotion. *J. Neurophysiol*., 120 (4): 1547-1557, 2018.
2. Chu MI**, Seto SH**, **Beloozerova IN**, Marlinski V. Strategies for obstacle avoidance during walking in the cat. *J. Neurophysiol*., 118(2): 817-831, 2017.
3. Zubair HN**, **Beloozerova IN**, Sun H****, Marlinski V. Head movement during walking in the cat. *Neuroscience,* 332: 101-120, 2016.
4. Farrell BJ***, Bulgakova MA, Sirota MG, Prilutsky BI, **Beloozerova IN**. Accurate stepping on a narrow path: mechanics, EMG and motor cortex activity in the cat. *J Neurophysiol.,* 114(5): 2682-2702, 2015.
5. Stout EE***, Sirota MG, **Beloozerova IN**. Known and unexpected constraints evoke different kinematic, muscle, and motor cortical neuron responses during locomotion. *Eur J Neurosci*., 42(9): 2666-2677, 2015.
6. Favorov OV, Nilaweera WU***, Miasnikov AA, **Beloozerova IN**. Activity of somatosensory-responsive neurons in high subdivisions of SI cortex during locomotion. *J. Neurosci*., 35(20): 7763-7776, 2015.
7. Rivers TJ, Sirota MG, Guttentag AI**, Ogorodnikov DA, Shah NA**, **Beloozerova IN**. Gaze shifts and fixations dominate gaze behavior of walking cats. *Neuroscience*, 275: 477-499, 2014.
8. Klishko AN, Farrell BJ***, **Beloozerova IN**, Latash ML, Prilutsky BI. Stabilization of cat paw trajectory during locomotion. *J. Neurophysiol*., 112(6): 1376-1391, 2014.
9. Farrell BJ***, Bulgakova MA, **Beloozerova IN**, Sirota MG, Prilutsky BI. Body stability and muscle and motor cortex activity during walking with wide stance. *J. Neurophysiol*.,112(3): 504-524, 2014.
10. Marlinski V, **Beloozerova IN**. Burst firing of neurons in the thalamic reticular nucleus during locomotion. *J. Neurophysiol*., 112(1): 181-192, 2014.
11. Armer MC*, Nilaweera WU***, Rivers TJ, Dasgupta NM**, **Beloozerova IN**. Effect of light on the activity of motor cortex during locomotion. *Behav. Brain Res*., 250: 238-250, 2013.
12. Stout EE***, **Beloozerova IN**. Differential responses of fast and slow conducting pyramidal tract neurons to changes in accuracy demands during locomotion. *J. Physiol*, 591(Pt 10):2647-66, 2013.
13. Marlinski V, Sirota MG, **Beloozerova IN**. Differential gating of thalamo-cortical signals by reticular nucleus of thalamus during locomotion. *J. Neurosci*., 32(45): 15823-15836, 2012.
14. Stout EE***, **Beloozerova IN**. Pyramidal tract neurons receptive to different forelimb joints act differently during locomotion. *J. Neurophysiol*., 107(7): 1890-1903, 2012.

15. Marlinski V, Nilaweera WU***, Zelenin PV, Sirota MG, **Beloozerova IN**. Signals from the ventro-lateral thalamus to the motor cortex during locomotion. *J. Neurophysiol*., 107(1): 455-472, 2012.
16. Zelenin PV, Deliagina TG, Orlovsky GN, Karayannidou A***, Stout EE**, Sirota MG, **Beloozerova IN**. Activity of motor cortex neurons during backward locomotion. *J. Neurophysiol.*, 105(6): 2698-2714, 2011.
17. Zelenin PV, Deliagina TG, Orlovsky GN, Karayannidou A***, Dasgupta NM**, Sirota MG, **Beloozerova IN**. Contribution of different limb controllers to modulation of motor cortex neurons during locomotion. *J. Neurosci*., 31: 4636-4649, 2011.
18. Zelenin PV, **Beloozerova IN**, Sirota MG, Orlovsky GN, Deliagina TG. Activity of red nucleus neurons in the cat during postural corrections. *J. Neurosci*., 30(43): 14533-14542, 2010.
19. **Beloozerova IN**, Farrell BJ***, Sirota MG, Prilutsky BI. Differences in movement mechanics, electromyographic, and motor cortex activity between accurate and non-accurate stepping. *J. Neurophysiol*., 103: 2285-2300, 2010.
20. Karayannidou A***, **Beloozerova IN**, Zelenin PV, Stout EE**, Sirota MG, Orlovsky GN, Deliagina TG. Activity of pyramidal tract neurons in the cat during standing and walking on an inclined plane. *J. Physiol. (L.)*, 587 (Pt 15): 3795-3811, 2009.
21. Karayannidou A***, Zelenin PV, Orlovsky GN, Sirota MG, **Beloozerova IN**, Deliagina TG. Maintenance of lateral stability during standing and walking in the cat. *J Neurophysiol*, 101(1): 8-19, 2009.
22. Karayannidou A***, Deliagina TG, Tamarova ZA, Sirota MG, Zelenin PV, Orlovsky GN, **Beloozerova IN**. Influences of sensory input from the limbs on feline corticospinal neurons during postural responses. *J. Physiol. (L)*, 586(Pt 1): 247-263, 2008.
23. Tamarova ZA, Sirota MG, Orlovsky GN, Deliagina TG, **Beloozerova IN**. Role of $GABA_A$ inhibition in modulation the activity of pyramidal tract neurons during postural corrections. *Eur J Neurosci.*, 25(5): 1484-1491, 2007.
24. Dunin-Barkowski WL, Sirota MG, Lovering AT, Orem JM, Vidruk EH, **Beloozerova IN**. Precise rhythmicity in activity of neocortical, thalamic and brain stem neurons in behaving cats and rabbits. *Behav. Brain Res.,* 175(1): 27-42, 2006.
25. Deliagina TG, Sirota MG, Zelenin PV, Orlovsky GN, **Beloozerova IN.** Interlimb postural coordination in the standing cat. *J. Physiol. (L)*, 573(Pt 1): 211-224, 2006.
26. **Beloozerova IN**, Sirota MG, Orlovsky GN, Deliagina TG. Comparison of activity of individual pyramidal tract neurons during balancing, locomotion, and scratching. *Behav. Brain Res.*, 169(1): 98-110, 2006.
27. Sirota MG, Pavlova GA, **Beloozerova IN.** Activity of the motor cortex during scratching. *J. Neurophysiol*., 95(2): 753-765, 2006.
28. Sirota MG, Swadlow HA, **Beloozerova IN**. Three channels of corticothalamic communication during locomotion. *J. Neurosci.,* 25(25): 5915-5925, 2005.
29. Prilutsky BI, Sirota MG, Gregor RJ, **Beloozerova IN**. Quantification of motor cortex activity and full-body biomechanics during unconstrained locomotion. *J. Neurophysiol.*, 94(4): 2959-69, 2005.
30. **Beloozerova IN**, Sirota MG, Orlovsky GN, Deliagina TG. Activity of pyramidal tract neurons in the cat during postural corrections. *J. Neurophysiol.*, 93(4): 1831-1844, 2005.

31. **Beloozerova IN**, Rossignol S. Antidromic discharges in dorsal roots of decerebrate cats. II: studies during treadmill locomotion. *Brain Res.*, 996(2): 227-236, 2004.

32. **Beloozerova IN**, Zelenin PV, Popova LB, Orlovsky GN, Grillner S, Deliagina TG. Postural control in the rabbit maintaining balance on the tilting platform. *J. Neurophysiol.*, 90(6): 3783-3793, 2003.

33. **Beloozerova IN**, Sirota MG, Swadlow HA, Orlovsky GN, Popova LB, Deliagina TG. Activity of different classes of neurons of the motor cortex during postural corrections. *J. Neurosci.*, 23(21): 7844-7853, 2003.

34. **Beloozerova IN**, Sirota MG. Integration of motor and visual information in the parietal area 5 during locomotion. *J. Neurophysiol.*, 90(2): 961-971, 2003.

35. **Beloozerova IN**, Sirota MG, Swadlow HA. Activity of different classes of neurons of the motor cortex during locomotion. *J. Neurosci.*, 23(3): 1087-1097, 2003.

36. Deliagina T, **Beloozerova IN**, Popova LB, Sirota MG, Swadlow HA, Grant G, Orlovsky GN. Role of different sensory inputs for maintenance of body posture in sitting rat and rabbit. *Motor Control*, 4(4): 439-452, 2000.

37. **Beloozerova I**, Rossignol S. Antidromic discharges in dorsal roots of decerebrate cats. I. Studies at rest and during fictive locomotion. *Brain Res.,* 846(1): 87-105, 1999.

38. **Beloozerova IN**, Sirota MG. Cortically controlled gait adjustments in the cat. *Ann N Y Acad Sci*, 860: 550-553, 1998.

39. Swadlow HA, **Beloozerova IN,** Sirota MG. Sharp, local synchrony among putative feed-forward inhibitory interneurons of rabbit somatosensory cortex. *J. Neurophysiol.,* 79(2): 567-582, 1998.

40. **Beloozerova IN**, Sirota MG. The role of the motor cortex in the control of vigour of locomotor movements in the cat. *J. Physiol. (L.),* 461: 27-46, 1993.

41. **Beloozerova IN**, Sirota MG. The role of the motor cortex in the control of accuracy of locomotor movements in the cat. *J. Physiol. (L.),* 461: 1-25, 1993.

42. Correia MJ, Perachio AA, Dickman JD, Kozlovskaya IB, Sirota MG, Yakushin SB***, **Beloozerova IN**. Changes in monkey horizontal semicircular canal afferent responses after spaceflight. *J. Appl. Physiol.*, 73(2 Suppl): 112S-120S, 1992.

43. Kozlovskaya IB, Ilyin EA, Sirota MG, Korolkov VI, Babayev BM***, **Beloozerova IN**, Yakushin SB. Studies of space adaptation syndrome in experiments on primates performed on board of soviet biosatellite "Cosmos-1887". *The Physiologist*, 32(1 Suppl): S45-48, 1989.

44. Sirota MG, Babaev BM***, **Beloozerova IN**, Nyrova AN, Yakushin SB***, Kozlovskaya IB. Neuronal activity of Nucleus vestibularis during coordinated movement of eyes and head in microgravitation. *The Physiologist*, 31(1 Suppl): S8-9, 1988.

45. Sirota MG, Babaev BM***, **Beloozerova IN**, Nyrova AN, Kozlovskaya IB. Characteristic of vestibular reactions to canal and otolith stimulation at an early stage of exposure to microgravity. *The Physiologist*, 30 (1 Suppl): S82-84, 1987.

46. **Beloozerova IN**, Sirota MG. [Activity of neurons of the motor-sensory cortex of the cat during natural locomotion while stepping over obstacles] *Neirofiziologiia,* 18(4): 546-549, 1986. Russian. (PMID: 3762798).

47. **Beloozerova IN**, Sirota MG. [Activity of neurons of the motor-sensory cortex of the cat during natural walking on the rungs of a horizontal ladder] *Neirofiziologiia*, 18(4): 543-545, 1986. Russian. (PMID: 3762797).

48. **Beloozerova IN**, Sirota MG. [Construction for recording neuronal activity in the unrestrained cat] *Zh Vyssh Nerv Deiat Im I P Pavlova*, 36(6): 1149-1151, 1986. Russian. (PMID: 3564694).

49. **Beloozerova IN**, Sirota MG. [Activity of neurons of the motosensory cortex during natural locomotion in the cat] *Neirofiziologiia*, 17(3): 406-408, 1985. Russian. (PMID: 4022189).

50. Arshavsky YuI, **Beloozerova IN**, Orlovsky GN, Panchin YuV, Pavlova GA. Control of locomotion in marine mollusc Clione limacina. IV. Role of type 12 interneurons. *Exp. Brain Res.*, 58(2): 285-293, 1985.

51. Arshavsky YuI, **Beloozerova IN**, Orlovsky GN, Panchin YuV, Pavlova GA. Control of locomotion in marine mollusc Clione limacina. III. On the origin of locomotory rhythm. *Exp. Brain Res.*, 58(2): 273-284, 1985.

52. Arshavsky YuI, **Beloozerova IN**, Orlovsky GN, Panchin YuV, Pavlova GA. Control of locomotion in marine mollusc Clione limacina. II. Rhythmic neurons of pedal ganglia. *Exp. Brain Res.*, 58(2): 263-272, 1985.

53. Arshavsky YuI, **Beloozerova IN**, Orlovsky GN, Panchin YuV, Pavlova GA. Control of locomotion in marine mollusc Clione limacina. I. Efferent activity during actual and fictitious swimming. *Exp. Brain Res.*, 58(2): 255-262, 1985.

54. Kozlovskaya IB, Babaev BM, Barmin VA, **Beloozerova IN,** Kreidich YuV, Sirota MG. The effect of weightlessness on motor and vestibulo-motor reactions. *The Physiologist,* 27(6): 111-114, 1984.

55. Arshavskii IuI, **Beloozerova IN**, Orlovskii GN, Pavlova GA, Panchin IuV. [Neurons of the pedal ganglia of a pteropod mollusk regulating locomotor generator function] *Neirofiziologiia,* 16(4): 543-546, 1984. Russian. (PMID: 6493402).

56. Arshavskii IuI, **Beloozerova IN**, Orlovskii GN, Pavlova GA, Panchin IuV. [Interneuron activity of the pedal ganglia of pteropod mollusks during generation of locomotor rhythms] *Neirofiziologiia,* 16(2): 272-275, 1984. Russian. (PMID: 6330586).

57. Arshavskii IuI, **Beloozerova IN**, Orlovskii GN, Pavlova GA, Panchin IuV. [Motor neuron activity of the pedal ganglia of pteropod mollusks during generation of locomotor rhythms] *Neirofiziologiia,* 16(2): 269-271, 1984. Russian. (PMID: 6330585).

58. Arshavskii IuI, **Beloozerova IN**, Orlovskii GN, Panchin IuV. [Effect of serotonin and theophylline on generation of rhythmic activity in the buccal ganglia of gastropod mollusks] *Neirofiziologiia,* 15(3): 321-323, 1983. Russian. (PMID: 6877435).

Book chapters and reviews

1. Deliagina TG, **Beloozerova IN**, Orlovsky GN, Zelenin PV. Contribution of supraspinal systems to generation of automatic postural responses. *Front. Integr. Neurosci.*, 8: 76, 2014.
2. **Beloozerova IN**, Stout EE***, Sirota MG. Distinct thalamo-cortical controls for shoulder, elbow, and wrist during locomotion. *Front. Comput. Neurosci.,* 7:62, 2013.
3. Deliagina TG, **Beloozerova IN**, Zelenin PV, Orlovsky GN. Spinal and supraspinal postural networks. *Brain Res Rev*, 57(1): 212-221, 2008.
4. Deliagina TG, Zelenin PV, **Beloozerova IN**, Orlovsky GN. Neuronal mechanisms controlling body posture. *Physiol Behav*, 92(1-2): 148-54, 2007.
5. Deliagina TG, Orlovsky GN, Zelenin PV, **Beloozerova IN.** Neural bases of postural control. *Physiology (Bethesda)* 21: 216-225, 2006.
6. **Beloozerova IN**, Sirota MG. Role of motor cortex in control of walking. *Barrow Quarterly* 21(3): 4-7, 2005.
7. Rossignol S, **Beloozerova IN**, Gossard J-P, Dubuc R. Presynaptic mechanisms during locomotion. – In: *Presynaptic Inhibition and Neural Control Mechanisms*. Eds: P.Rudomin, R.Romo, L.Mendel; Oxford Univ. Press, 1998.
8. **Beloozerova IN,** Sirota MG. Role of motor cortex in control of locomotion. - In: *Stance and Motion. Facts and Concepts*. Eds: V.S.Gurfinkel, M.E.Ioffe, J.Massion, J.P.Roll, Plenum Press, New York - London, p.163-176, 1988.
9. Shipov AA, Sirota MG, Babaev BM***, **Beloozerova IN,** Yakushin SB***, Kozlovskaya IB. Results of tests on the primate vestibulo-visuomotor reactions in biocosmos experiments. - In: *Adaptive Processes in visual and oculomotor systems*. Eds: E.L.Keller, D.S.Zee, Pergamon Press, NY, 129-132, 1986.
10. **Beloozerova IN,** Sirota MG. Activity of motosensory cortex cells during skilled locomotion of the cat. - In: *The actual problems of the space biology and medicine*, Moscow, Science Press, p.132-140, 1986.

Presentations at conferences, etc.

I have made **over 100 presentations at international meetings** (mostly posters at the annual Society for Neuroscience meetings, but also some oral presentations at these and other meetings, including invited talks, the most recent one was at the Yamada Symposium 2017 “Neuroimaging of Natural Behaviors” in Tokyo, Japan, by invitation of Dr. Hirokazu Tanaka from the Japan Advanced Institute of Science and Technology).

I am the organizer of a minisymposium “Cortical Control of Locomotion and Posture" that was held at the 2018 Society for Neuroscience meeting in San Diego.

I have delivered numerous presentations at local conferences and uncountable seminar talks.

MY CONTRIBUTION TO SCIENCE (NIH format) **Irina Beloozerova**

1. My career in neuroscience started in the Institute of Problems of Information Transmission in Moscow, USSR, where under supervision of Drs. Grigori Orlovsky and Yuri Arshavsky, I have contributed to **studies of cellular mechanisms of behavior in mollusks**. The major accomplishment of this work during my time in the laboratory **(1980–83)** was the description of cellular mechanism of swimming generator in marine mollusk *Clione limacina***.** This was one of the first networks, functioning of which was thoroughly described in an invertebrate, and I was the first person to note identifiable neurons in *Clione*, a species other than *Aplysia*. This work is reflected in my 8 full size peer-reviewed original publications, most important of which are:

a. Arshavsky YuI, Beloozerova IN, Orlovsky GN, Panchin YuV, Pavlova GA. Control of locomotion in marine mollusc Clione limacina. I. Efferent activity during actual and fictitious swimming. *Exp. Brain Res.*, 58(2): 255-262, 1985.

b. Arshavsky YuI, Beloozerova IN, Orlovsky GN, Panchin YuV, Pavlova GA. Control of locomotion in marine mollusc Clione limacina. II. Rhythmic neurons of pedal ganglia. *Exp. Brain Res.*, 58(2): 263-272, 1985.

c. Arshavsky YuI, Beloozerova IN, Orlovsky GN, Panchin YuV, Pavlova GA. Control of locomotion in marine mollusc Clione limacina. III. On the origin of locomotory rhythm. *Exp. Brain Res.*, 58(2): 273-284, 1985.

d. Arshavsky YuI, Beloozerova IN, Orlovsky GN, Panchin YuV, Pavlova GA. Control of locomotion in marine mollusc Clione limacina. IV. Role of type 12 interneurons. *Exp Brain Res*, 58(2): 285-93, 1985.

2. During my following tenure at the Institute of Biomedical Problems, Moscow, USSR **(1981–93),** I have participated in the **Soviet Space Program with Rhesus monkeys** that was carried out aboard biosatellites "Cosmos". My major accomplishments were:

- First, to ensure that single unit recordings of high quality are obtained from head-unrestrained Rhesus monkeys over periods of months, including a spice flight, I, in collaboration with Dr. Mikhail Sirota, have developed an original method for extracellular recording of neuronal activity in freely moving animals (monkeys and cats) that is still in use in my and several other laboratories in the USA.

- In space studies on effects of weightlessness on gaze fixation reaction in Rhesus monkeys I, as a member of Dr. Kozlovskaya group, contributed to showing that: 1) The excitability of vestibular system observed in kinematics and dynamic parameters of eye and head movements increases dramatically during the first week of space flight; 2) The dynamic responses of neurons in Nucleus vestibularis lateralis and in floccular zone of cerebellum during gaze fixation and during lifting reaction increase in the first week of space flight; and 3) All adaptive changes in eye-head coordination and associated neuronal activity are completed within two weeks of space flight. This work is reflected in following original research reports published in English:

a. Sirota MG, Babaev BM, Beloozerova IN, Nyrova AN, Kozlovskaya IB. Characteristic of vestibular reactions to canal and otolith stimulation at an early stage of exposure to microgravity. *Physiologist*, 30 (1 Suppl.): S82-84, 1987.

b. Kozlovskaya IB, Babaev BM, Barmin BA, Beloozerova IN, Kreidich YuV, Sirota MG. The effect of weightlessness on motor and vestibulo-motor reactions. *Physiologist*, 27(6): 111‑ 114, 1984.

c. Sirota MG, Babaev BM, Beloozerova IN, Nyrova AN, Yakushin SB, Kozlovskaya IB. Neuronal activity of Nucleus vestibularis during coordinated movement of eyes and head in microgravitation. *Physiologist*, 31 (1 Suppl.): S8-9, 1988.

d. Kozlovskaya IB, Ilyin EA, Sirota MG, Korolkov VI, Babayev BM, Beloozerova IN, Yakushin SB. Studies of space adaptation syndrome in experiments on primates performed on board of soviet biosatellite "Cosmos-1887". *Physiologist*, 32 (1 Suppl.): S45-48, 1989.

e. Correia MJ, Perachio AA, Dickman JD, Kozlovskaya IB, Sirota MG, Yakushin SB, Beloozerova IN. Changes in monkey horizontal semicircular canal afferent responses after spaceflight. *J. Appl. Physiol.,* 73 (2 Suppl.): 112S-120S, 1992.

3. In addition, at the time when it was unclear whether motor cortex participates in control of locomotion, the most essential and frequently used behavior of all animals (**early and mid-80-ties**), I, working in **freely walking cats**, have showed that it does, and that this control concerns not with the vigour of the movements but with their spatial organization, the movement's accuracy. The work to reveal specifics of the control has continued later at the Barrow Neurological Institute in Phoenix, Arizona, and now at the Georgia Institute of Technology, Atlanta, Georgia (**2000- present**), and results are reflected in about a dozen of full size peer-reviewed original research reports overall, most important of which are:

a. Beloozerova IN, Sirota MG. The role of the motor cortex in the control of vigour of locomotor movements in the cat. *J. Physiol. (L.)*, 461: 27-46, 1993.

b. Beloozerova IN, Sirota MG. The role of the motor cortex in the control of accuracy of locomotor movements in the cat. *J. Physiol. (L.)*, 461: 1-25, 1993.

c. Beloozerova IN, Farrell BJ, Sirota MG, Prilutsky BI. Differences in movement mechanics, electromyographic, and motor cortex activity between accurate and non-accurate stepping. *J. Neurophysiol*., 103: 2285-2300, 2010.

d. Stout EE, Beloozerova IN. Differential responses of fast and slow conducting pyramidal tract neurons to changes in accuracy demands during locomotion. *J. Physiol (L.)*, 591(Pt 10): 2647-66, 2013.

e. Stout EE, Sirota MG, Beloozerova IN. Known and unexpected constraints evoke different kinematic, muscle, and motor cortical neuron responses during locomotion. *Eur. J Neurosci*. 42(9): 2666-77, 2015.

4. Over 18 years at the Barrow Neurological Institute I've lead several interesting studies:

- On how the thalamus and cortex act and interact for control of locomotion on complex terrains. In this series of studies, we have revealed physiological "faces" of several morphological classes of neurons in the thalamo-cortical network. We were the first to characterize the activity of the reticular nucleus of the thalamus during any motor behavior and to suggest the distinct roles of its shoulder- and wrist-related neuronal subpopulations in shaping locomotion-related discharges of neurons in the ventro-lateral thalamus, including those projecting to motor cortex (*J. Neurosci*., 32(45):15823-36, 2012; *J. Neurophysiol.,* 112(1): 181-192, 2014). We then showed that neurons from layer 6 of motor cortex that project solely back to the thalamus are only sparsely active during locomotion but their spikes are bundled into short bursts that are precisely timed to specific phases of the stride (*J. Neurosci.*, 25(25): 5915-5925, 2005). Recently we found that the activity of neurons in high subdivisions of primary somatosensory cortex (areas 1 and 2) during locomotion often represents the somatosensory events in a predictive fashion, that is, before they actually take place! (*J. Neurosci*., 35(20): 7763-76, 2015.)

- **On how vision controls locomotion.** We have recently developed a novel technique that allows a very accurate recording of gaze in freely walking cats, and found that during walking the gaze moves along surface in a step-like manner (*Neuroscience*, 275: 477-499, 2014; *cover paper*). Researching the activity of cortical parietal area 5, we have found four modes, by which this area integrates visual signals about heterogeneity of the surface with signals about the activity of basic locomotor mechanisms (*J. Neurophysiol.*, 90(2): 961-971, 2003). We then found that the ventro-lateral thalamus is not a simple cerebellum-to-cortex relay, but that it integrates and transmits to motor cortex visual information needed for correct feet placement on a complex terrain (*J. Neurophysiol.,* 107(1): 455-472, 2012). We ultimately found that the activity of neurons in motor cortex depends on whether the cat sees and uses vision during walking or not (*Behav. Brain Res*., 250: 238-250, 2013; plus a paper in review).

These were other exiting studies and findings as well, and results are presented in about two dozen of full size peer-reviewed original publications. It is difficult for me to tell, but probably my most important accomplishment in the field of locomotion research during my tenure at the Barrow Institute to date is a demonstration of the **distinct nervous controls for shoulder, elbow, and wrist during locomotion.** To achieve that, we first have characterized neurons in the thalamo-cortical network in respect to location of their somatosensory receptive field, analyzed their activities during locomotion, and found that the shoulder-, elbow-, and wrist-related subpopulations are active quite differently:

a. Stout EE, Beloozerova IN. Pyramidal tract neurons receptive to different forelimb joints act differently during locomotion. *J. Neurophysiol*., 107(7): 1890-1903, 2012.

b. Marlinski V, Nilaweera WU, Zelenin PV, Sirota MG, Beloozerova IN. Signals from the ventrolateral thalamus to the motor cortex during locomotion. *J. Neurophysiol*., 107(1): 455-472, 2012.

c. Marlinski V, Sirota MG, Beloozerova IN. Differential gating of thalamo-cortical signals by reticular nucleus of thalamus during locomotion. *J. Neurosci.,* 32(45): 15823-15836, 2012.

d. Marlinski V, Beloozerova IN. Burst firing of neurons in the thalamic reticular nucleus during locomotion. *J. Neurophysiol*., 112(1): 181-192, 2014.

- We have reviewed the initial part of neuronal activity data in: Beloozerova IN, Stout EE, Sirota MG. Distinct thalamo-cortical controls for shoulder, elbow, and wrist during locomotion. *Front. Comput. Neurosci*., 7:62, 2013.

Recently, we have also researched inter-segmental dynamics of the forelimb during locomotion and revealed the distinct roles of the muscle and passive torques in the movement of the proximal versus distal limb segments (Zubair et al., 2018). These findings partly explain differential activities of corresponding neuronal subpopulations throughout the thalamo-cortical network, and provide ground for hypotheses regarding functional effects of these activities during locomotion.

5. In addition, during my tenure at the Barrow Institute, our laboratory has pioneered research on **cortical neuronal mechanisms of posture and balance**. These studies were conducted in collaboration with Dr. Boris Prilutsky at the Georgia Institute of Technology, and with Drs. Deliagina, Zelenin, and Orlovsky at Karolinska Institute in Stockholm, Sweden. We have established that motor cortex closely participates in maintenance of a task-specific posture and balance and have characterized the roles of several efferent sub-populations of motor cortex and red nucleus in maintenance of posture and balance. Results are presented in 13 full size original publications, most important of which are:

a. Beloozerova IN, Sirota MG, Swadlow HA, Orlovsky GN, Popova LB, Deliagina TG. Activity of different classes of neurons of the motor cortex during postural corrections. *J. Neurosci*., 23(21): 7844-7853, 2003.

b. Karayannidou A, Deliagina TG, Tamarova ZA, Sirota MG, Zelenin PV, Orlovsky GN, Beloozerova IN. Influences of sensory input from the limbs on feline corticospinal neurons during postural responses. *J. Physiol. (L.)*, 586 (Pt 1): 247-263, 2008.

c. Zelenin PV, Beloozerova IN, Sirota MG, Orlovsky GN, Deliagina TG. Activity of red nucleus neurons in the cat during postural corrections. *J. Neurosci.*, 30(43): 14533-14542, 2010.

d. Farrell BJ, Bulgakova MA, Beloozerova IN, Sirota MG, Prilutsky BI. Body stability and muscle and motor cortex activity during walking with wide stance. *J. Neurophysiol.*, 112(3): 504-524, 2014.

e. Farrell BJ, Bulgakova MA, Sirota MG, Prilutsky BI, Beloozerova IN. Accurate stepping on a narrow path: mechanics, EMG and motor cortex activity in the cat. *J. Neurophysiol.*. 114(5): 2682-2702, 2015.

- We have reviewed a part of results on this topic in: Deliagina, Beloozerova, Orlovky, Zelenin. Contribution of supraspinal systems to generation of automatic postural responses. *Front Integr. Neurosci.,* 8:76, 2014.

STUDY SECTIONS and EDITORIAL WORK:

NIH, special panel on Musculoskeletal rehabilitation (ZRG1 MOSS), fall 2009, spring-summer 2010, spring 2011
NIH, Neurotoxicology and Alcohol (NAL) study section, winter 2010 (ad hoc)
National Science Foundation (BIO, ad hoc since 2004; Graduate Research Fellowship Program, panelist, 2016)
Israel Science Foundation (ad hoc)
UK Research Councils (RCUK) (ad hoc)
Associate Editor with Frontiers in Neuroscience and Frontiers in Neurology
Reviewer for Journals: Cerebral Cortex
Experimantal Brain Res.
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Neurocomputing
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Title: Forebrain control of locomotion
Period: 12/2007-12/2012, through 12/2014 – no cost extension
Role: PI

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Title: Forebrain control of locomotion (ARRA competitive supplement for undergraduate students).
Period: 07/2009-07/2011
Role: PI

NIH/NINDS, R01 NS-39340
Title: Motor cortex and thalamo-cortical network in locomotion
Period: 05/2000-05/2005
Role: PI

NIH/NINDS, F32 NS-10314
Title: Subpopulations of motor cortical neurons in locomotion.
Period: 01/01/1997-12/31/1999 (competitively renewed in 1998)
Role: PI