Andrea d'Avella

Department of Biomedical and Dental Sciences and Morphofunctional Imaging
University of Messina
Italy

Via Consolare Valeria 1
98124 Messina
Phone: 090 221 3329
E-mail: andrea.davella@unime.it

Degrees

Massachusetts Institute of Technology Cambridge, MA, USA
September, 2000. Ph.D. Degree, Department of Brain and Cognitive Sciences,. Thesis: “Modular Control of Natural Motor Behavior”.

University of Milan Milan, Italy
December, 1993. Laurea Degree (equivalent to M.S.), magna cum laude. Thesis in high-energy physics: “Study of double-sided microstrip detectors and front-end electronics for the ATLAS experiment at LHC”.

Summer courses and other training

Marine Biological Laboratory Woods Hole, MA, USA
June, 1998 – August, 1998. Summer course on Neural Systems and Behavior.

Dartmouth College and Medical School Hanover, NH, USA
July, 1996. McDonnell Summer Institute in Cognitive Neuroscience.

Microprocessor Laboratory, ICTP Trieste, Italy
November, 1994 – December, 1994. Third Course on Basic VLSI Design Techniques.

CERN (European Laboratory for Particle Physics) Geneva, Switzerland
October, 1992 – June, 1993. Graduate training in High-Energy Physics.

Positions

University of Messina Messina, Italy
January 2015 – today. Full Professor of Physiology, Department of Biomedical and Dental Sciences and Morphofunctional Imaging.

IRCCS Fondazione Santa Lucia Rome, Italy
January, 2003 – today. Team leader, *Laboratory of Neuromotor Physiology.* Research topics: human arm and hand motor control; muscle synergies during reaching and interception; computational techniques for the analysis of muscle patterns; myoelectric control; changes in muscle synergies after neurological damage.

Massachusetts Institute of Technology Cambridge, MA, USA
September, 2000 – December 2002. *Postdoctoral Associate, Dept. of Brain and Cognitive Sciences.* Modular control of hand movements in human and non-human primates: kinematics and EMGs recording during grasping and manipulation. Supervisor: Emilio Bizzi.

September, 1995 – August,2000. Research Assistant. Modular organization of the motor system: combinations of muscle synergies in the construction of natural motor behaviors. Advisor: Emilio Bizzi.

INFN, Milan Division Milan, Italy
September, 1994 – August 1995, Research Fellow. Design of a digital VLSI chip for the readout of the silicon pixel detectors of the ATLAS experiment at Large Hadron Collider at CERN. Advisor: Francesco Ragusa.

CERN, Particle Physics Experiments Division Geneva, Switzerland
September 1992 – June, 1994, Research Associate. Development and test of silicon detectors and readout electronics for particle physics experiments. Advisor: Laura Perasso. Monte-Carlo simulation of leptoquark production at LHC. Advisor: Daniel Froidevaux.

Project Coordinator of an Italian Ministry of University and Research project (PRIN,

Grants

February 2017 – January 2020)

Principal Investigator (Unit Coordinator) in a collaborative project funded by the EU Commission (CogIMon, H2020-ICT No 644727, February 2015 – January 2019)

Project coordinator in an Italian Ministry of Health research project (RF-2011-02347869, December 2014 - August 2018)

Principal Investigator (Unit Coordinator) in an Integrated Project funded by the EU Commission (FP7-ICT AMARSi, No 248311, March 2010 – February 2014)

Principal Investigator in a Collaborative Project funded by the EU Commission (FP7-ICT MINDWALKER, No 247959, January 2010 – May 2013)

Principal Investigator (Project Coordinator) in an international collaborative research project funded by the Human Frontier Science Program Organization (RPG11/2008, October 2008 – September 2012).

Principal Investigator in a Biotechnology for Human Space Exploration Project funded by the Italian Space Agency (CRUSOE, May 2011 – April 2012).

Research visits

National Center of Neurology and Psychiatry Tokyo, Japan
July – August 2017. Visiting Fellow in Kazuhiko Seki's laboratory

Massachusetts Institute of Technology Cambridge, MA, USA
July 2003 – August 2003, July 2004 – August 2004, *August 2005*, *July 2012 – August 2012, February – May 2015. Visiting Scientist* in Emilio Bizzi's laboratory.

Imperial College London, UK
August 2013. Visiting Scientist Etienne Burdet's laboratory.

University of British Columbia Vancouver, Canada
July 2011 – August 2011. Visiting Scientist in Dinesh K. Pai's laboratory.

Teaching

University of Messina Italy

Fall 2017 and 2018. Coordinator of the Human Physiology course in the Medicine and Surgery program.

Fall 2016. Coordinator of the Human Physiology course in the Medicine and Surgery program; Instructor in Neurophysiology in the Movement Science program.

Fall 2015. Coordinator of the Human Physiology course in the Medicine and Surgery program; Instructor in Neurophysiology in Movement Science and Physiotherapy programs.

Massachusetts Institute of Technology Cambridge, MA, USA

Spring 1997 and 2000. Teaching Assistant, Brain and Behavior Laboratory, Prof. Earl Miller.

Fall 1996. Teaching Assistant, Introduction to Psychology, Prof. Steve Pinker.

Student and postdoc supervision

Paolo De Pasquale, pre-graduate fellow, September 2017 – today.
Valeria Falzarano, pre-graduate fellow, September 2017 – September 2018.
Paolo Tommasino, post-doc, September 2017 – today.
Antonella Maselli, post-doc, July 2015 – today.
Aishwar Dhawan, post-doc, July 2015 – June 2016.
Francesca Ferrari, pre-graduate fellow, February 2005 – March 2016.
Marta Russo, pre-graduate fellow and PhD student, January 2013 – September 2018.
Mattia D'Andola, pre-graduate fellow, January 2011 – January 2013.
Daniele Borzelli, pre-graduate fellow, September 2010 – September 2014; post-doc

February 2018 – today.
Denise Berger, post-doc, July 2010 – today.
Reinhard Gentner, post-doc, March 2009 – July 2010.
Benedetta Cesqui, post-doc, September 2008 – July 2018.
Michele Andrea Pisauro, M.S. student, September 2008 – July 2009.
Laure Fernandez, post-doc, January 2005 – August 2006.
Alessandro Portone, Ph.D. student, January 2005 – December 2008.
Thimotheé Doutriaux, M.S. student, November 2002 – May 2004.
Vincent C-K Cheung, Ph.D. student, September 2001 – December 2007.
Simon A Overduin, Ph.D. student, September 2000 – December 2005.

Awards

Japan Society for the Promotion of Science, Invitation Fellowship for Research in Japan, January 2017.

ItaliaCamp Rome "Your idea for the country" competition, Healthcare and technology transfer section winner, November 2010.

Poitras Pre-Doctoral Fellowship, May 1999.

Dwek Fellowship in the Neurosciences, July 1997.

INFN (National Institute for Nuclear Physics, Italy) Post-laurea research fellowship, ranked first in national competition, September 1994.

Publications

h-index (Scopus): 31
Number of citations (Scopus): 4637

Citation data available on Scopus on July 17, 2019

Selected publications:

1. Borzelli D., Cesqui B., Berger D.J., Burdet E., d'Avella A., "Muscle patterns underlying voluntary modulation of co-contraction", 2018, **PLoS ONE**, in press.
2. Maselli A., Dhawan A., Cesqui B., Russo M., Lacquaniti F., d'Avella A., "Where Are You Throwing the Ball? I Better Watch Your Body, Not Just Your Arm!", 2017, **Front Hum Neurosci**,11:505. *(times cited: 1)*
3. Russo M., Cesqui B., La Scaleia B., Ceccarelli F., Maselli A., Moscatelli A., Zago M., Lacquaniti F., d'Avella A., "Intercepting virtual balls approaching under different gravity conditions: Evidence for spatial prediction", 2017, **J Neurophysiol**, 118(4):2421-2434. *(times cited: 7)*
4. Cesqui B., Russo M., Lacquaniti F., d'Avella A., "Grasping in One-Handed Catching in Relation to Performance.", 2016, **PLoS One**, 11(7):e0158606. *(times cited: 2)*
5. Overduin S.A., d'Avella A., Roh J., Carmena J.M., Bizzi E., "Representation of Muscle Synergies in the Primate Brain", 2015, **J Neurosci**, 35(37):12615-24. *(times cited: 61)*
6. Cesqui B., Mezzetti M., Lacquaniti F., d'Avella A., "Gaze behavior in one-handed catching and its relation with interceptive performance: what the eyes can't tell.", 2015, **PLoS One**,10(3):e0119445. *(times cited: 15)*
7. Berger D.J. and d'Avella A., "Effective force control by muscle synergies", 2014, **Front Comput Neurosci**, 8:46. *(times cited: 76)*
8. Berger D.J., Gentner R., Edmunds T., Pai D.K., d'Avella A., "Differences in adaptation rates after virtual surgeries provide direct evidence for modularity", 2013, **J Neurosci**, 33(30):12384-94. *(times cited: 70)*
9. Overduin S.A. , d'Avella A., Carmena J., Bizzi E., "Microstimulation Activates a Handful of Muscle Synergies", 2012, **Neuron**, 76(6):1071-7. *(times cited: 138)*
10. Cesqui B., d'Avella A., Portone A., Lacquaniti F., "Catching a ball at the right time and place: individual factors matter.", 2012, **PLoS One**, 7(2):e31770. *(times cited: 32)*
11. Dominici N., Ivanenko Y.P., Cappellini G., d'Avella A. et al., "Locomotor primitives in newborn babies and their development", 2011, **Science**, 334(6058):997-9. *(times cited: 275)*
12. d'Avella A., Portone A., Lacquaniti F., "Superposition and modulation of muscle synergies for reaching in response to a change in target location", 2011, **J Neurophysiol**, 106(6):2796-812. *(times cited: 51)*

13. Muceli S., Boye A.T., d'Avella A., Farina D., "Identifying representative synergy matrixes for describing muscular activation patterns during multi-directional reaching in the horizontal plane.", 2010, **J Neurophysiol**, 103(3): p. 1532-42. *(times cited: 96)*
14. d'Avella A., Fernandez L., Portone A., Lacquaniti F., "Modulation of phasic and tonic muscle synergies with reaching direction and speed", 2008, **J Neurophysiol**, 100(3): p. 1433-54. *(times cited: 135)*
15. Overduin S.A., d'Avella A., Roh J., Bizzi E., "Modulation of muscle synergy recruitment in primate grasping", 2008, **J Neurosci**, 28(4):880-92. *(times cited: 124)*
16. d'Avella A., Portone A., Fernandez L., Lacquaniti F., "Control of Fast-Reaching Movements by Muscle Synergy Combinations", 2006, **J Neurosci**, 26(30): p. 7791-7810. *(times cited: 344)*
17. Tresch M.C , Cheung V.C, d'Avella A., "Matrix factorization algorithms for the identification of muscle synergies: evaluation on simulated and experimental data sets.", 2006, **J Neurophysiol** 95(4):2199-212. *(times cited: 353)*
18. Cheung V.C, d'Avella A., Tresch M.C, and Bizzi E., "Central and sensory contributions to the activation and organization of muscle synergies during natural motor behaviors". 2005, **J Neurosci**, 25(27): p. 6419-34. *(times cited: 222)*
19. d'Avella A. and Bizzi, E., "Shared and specific muscle synergies in natural motor behaviors". 2005, **Proc Natl Acad Sci U S A**, 102(8): p. 3076-81. *(times cited: 351)*
20. d'Avella A., Saltiel P., Bizzi E., "Combinations of muscle synergies in the construction of a natural motor behavior", 2003, **Nat Neurosci**, 6(3): 300-308. *(times cited: 657)*
21. d'Avella, A. and Bizzi, E., "Low dimensionality of supraspinally induced force fields", **Proc Natl Acad Sci USA**, 1998, 95(13): 7711-7714. *(times cited: 41)*

Other peer-reviewed publications:

22. Ceccarelli F., La Scaleia B., Russo M., Cesqui B., Gravano S., Mezzetti M., Moscatelli A., d'Avella A., Lacquaniti F., Zago M., "Rolling Motion Along an Incline: Visual Sensitivity to the Relation Between Acceleration and Slope.", 2018, **Front Neurosci**,12:406. *(times cited: 2)*
23. Sylos-Labini F., d'Avella A., Lacquaniti F., Ivanenko Y., "Human-Human Interaction Forces and Interlimb Coordination During Side-by-Side Walking With Hand Contact.", 2018, **Front Physiol**, 9:179. *(times cited: 5)*
24. Prevete R., Donnarumma F., d'Avella A., Pezzulo G., "Evidence for sparse synergies in grasping actions.", 2018, **Sci Rep** 12;8(1):616. *(times cited: 2)*
25. Saltiel P., d'Avella A., Tresch M.C., Wyler-Duda K., Bizzi E., "Critical Points and Traveling Wave in Locomotion: Experimental Evidence and Some Theoretical Considerations", 2017, **Front Neural Circuits**, 11:98. *(times cited: 2)*
26. d'Avella A., "Integration of robotics and neuroscience beyond the hand: What kind of synergies?. Comment on "Hand synergies: Integration of robotics and neuroscience for understanding the control of biological and artificial hands" by Marco Santello et al.", 2016, **Physics of Life Reviews**, 17:33-5. *(times cited: 1)*
27. Saltiel P., d'Avella A., Wyler-Duda K., Bizzi E., "Synergy temporal sequences and topography in the spinal cord: evidence for a traveling wave in frog locomotion", 2015, **Brain Struct Funct**, 221(8):3869-3890. *(times cited: 12)*
28. d'Avella A., Giese M, Ivanenko YP, Schack T., Flash T., "Editorial: Modularity in motor control: from muscle synergies to cognitive action representation", 2015, **Front Comput Neurosci**, 9:126. *(times cited: 27)*
29. Lunardini F., Casellato C., d'Avella A., Sanger T., Pedrocchi A., "Robustness and Reliability of Synergy-Based Myocontrol of a Multiple Degree of Freedom Robotic Arm", 2015, **IEEE Trans Neural Syst Rehabil Eng**, 24(9): 940-950. *(times cited: 14)*
30. Martino G., Ivanenko Y.P., d'Avella A., Serrao M., et al., "Neuromuscular adjustments of gait associated with unstable conditions", 2015, **J Neurophysiol**, 114(5):2867-82. *(times cited: 41)*
31. Martino G., Ivanenko Y.P., Serrao M., Ranavolo A., d'Avella A. et al., "Locomotor patterns in cerebellar ataxia", 2014, **J Neurophysiol**, 112(11):2810-21. *(times cited: 41)*
32. Sylos-Labini F., La Scaleia V., d'Avella A. et al.," EMG patterns during assisted

walking in the exoskeleton", 2014, **Front Hum Neurosci**, 8:423. *(times cited: 53)*

33. Overduin S.A. , d'Avella A., Carmena J., Bizzi E., "Muscle synergies evoked by microstimulation are preferentially encoded during behavior", 2014, **Front Comput Neurosci**, 2014, 8:20. *(times cited: 36)*
34. Russo M., D'Andola M., Portone A., Lacquaniti F., and d'Avella A., "Dimensionality of joint torques and muscle patterns for reaching.", 2014, **Front Comput Neurosci**, 8:24. *(times cited: 20)*
35. Lacquaniti F., Carrozzo M., d'Avella A., La Scaleia B., Moscatelli A., Zago M., "How long did it last? You would better ask a human.", 2014, **Front Neurorobot**, 8:2. *(times cited: 8)*
36. Alessandro C., Carbajal J.P., d'Avella A., "A computational analysis of motor synergies by dynamic response decomposition.", 2014, **Front Comput Neurosci**, 7:191. *(times cited: 12)*
37. Borzelli D., Berger D.J., Pai D.K., d'Avella A., "Effort minimization and synergistic muscle recruitment for three-dimensional force generation.", 2013, **Front Comput Neurosci**, 7:186. *(times cited: 15)*
38. Rückert, E., d'Avella, A., "Learned parametrized dynamic movement primitives with shared synergies for controlling robotic and musculoskeletal systems.", 2013, **Front Comput Neurosci***,* 7(138). *(times cited: 26)*
39. Gentner R., Edmunds T., Pai D.K., d'Avella A., "Robustness of muscle synergies during visuomotor adaptation.", 2013, **Front Comput Neurosci**,7:120. *(times cited: 22)*
40. D'Andola, M., Cesqui, B., Portone, A., Fernandez, L., Lacquaniti, F., d'Avella, A., "Spatiotemporal characteristics of muscle patterns for ball catching", 2013, **Front Comput Neurosci***,* 7(107). *(times cited: 18)*
41. Lacquaniti F., Ivanenko Y.P., d'Avella A., Zelik K.E., Zago M., "Evolutionary and developmental modules", 2013, **Front Comput Neurosci**, 7:61. *(times cited: 31)*
42. d'Avella A., Lacquaniti F., "Control of reaching movements by muscle synergy combinations", 2013, **Front Comput Neurosci**, 7:42. *(times cited: 75)*
43. Cesqui, B., de Langenberg, R., Lacquaniti, F., and d'Avella, A., "A novel method for measuring gaze orientation in space in unrestrained head conditions", 2013, **J Vis***,*13(8). *(times cited: 9)*
44. d'Avella A., Cesqui B., Portone A., Lacquaniti F.,"A new ball launching system with controlled flight parameters for catching experiments", 2011, **J Neurosci Methods**, 196: p.264-275. *(times cited: 7)*
45. d'Avella A. and Pai D.K., "Modularity for Sensorimotor Control: Evidence and a New Prediction", 2010, **J Mot Behav**, 42(6): p. 362-269. *(times cited: 32)*
46. Overduin S.A., Zaheer F., Bizzi E., d'Avella A., "An instrumented glove for small primates", J Neurosci Methods, 2010, **J Neurosci Methods**, 187(1):100-4. *(times cited: 7)*
47. Jiang N., Falla D., d'Avella A., Graimann B., Farina D., "Myoelectric control in neurorehabilitation", 2010, **Crit Rev Biomed Eng**, 38(4):381-91. *(times cited: 25)*
48. Cheung V.C., d'Avella A., and Bizzi E., "Adjustments of motor pattern for load compensation via modulated activations of muscle synergies during natural behaviors.", 2009, **J Neurophysiol**, 101(3):1235-57. *(times cited: 62)*
49. Ivanenko Y.P., d'Avella A., Poppele R.E., Lacquaniti F.,"On the origin of planar covariation of elevation angles during human locomotion", 2008, **J Neurophysiol**, 99(4):1890-8. *(times cited: 68)*
50. Bizzi E., Cheung V.C., d'Avella A., Saltiel P., Tresch M., "Combining modules for movement", 2008, **Brain Res Rev**, 57(1):125-33. *(times cited: 278)*
51. Saltiel P., Wyler-Duda K., d'Avella A., Ajemian R.J., and Bizzi E., "Localization and connectivity in spinal interneuronal networks: the adduction-caudal extension-flexion rhythm in the frog". 2005, **J Neurophysiol**, 94(3): p. 2120-38. *(times cited: 19)*
52. Tresch M.C., Saltiel P., d'Avella A., Bizzi E., "Coordination and localization in spinal motor systems", 2002, **Brain Res Brain Res Rev**, 40: 66-79. *(times cited: 106)*
53. Bizzi E., d'Avella A., Saltiel P., Tresch M.C., "Modular organization of spinal motor systems", 2002, **Neuroscientist**, 8(5): 437-442. *(times cited: 80)*
54. Bizzi, E., Tresch, M.C., Saltiel, P. and d'Avella, A., "New perspectives on spinal motor systems", **Nat Rev Neurosci**, 2000, 2: 101-108. *(times cited: 160)*
55. Saltiel, P., Wyler-Duda, K., d'Avella, A., Tresch, M.C., and Bizzi, E., "Muscle synergies encoded within the spinal cord: evidence from focal intraspinal NMDA iontophoresis in the frog", **J Neurophysiol**, 2001, 85(2): 605-619. *(times cited:*