# BRUNO GRASSI, MD PhD

Professor of Physiology, FACSM, FAPS

## CURRICULUM VITAE

### PERSONAL INFORMATION


**Name:** Bruno Grassi
**Date of birth:** January 6th 1958
**Nationality:** Italian
**Home address:** Viale Volontari della Libertà 4
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**Mother Tongue:** Italian
**Other languages:** English, fluently spoken and written.

### EDUCATION

1984 Medical Doctor, University of Milano, Italy.
1987 Postgraduate Specialization in Sports Medicine, University of Milano.
1992 PhD in Human Physiology, University of Milano (Supervisor Prof. Paolo Cerretelli).

### ACADEMIC CAREER

1987 Research Scholarship, San Raffaele Hospital Scientific Institute, Milano, Italy.
1991–2001 Researcher, Institute of Advanced Biomedical Technologies, National Research Council, Milano.
2001–2007 Associate Professor of Physiology, School of Medicine, University of Milano.
2007–2010 Associate Professor of Physiology, School of Medicine, University of Udine, Italy.
Since 2010 Professor of Physiology, School of Medicine, University of Udine.

### OTHER APPOINTMENTS

2012-2017 Coordinator, Undergraduate School of Motor Sciences, University of Udine.
2013-2017 Coordinator, Postgraduate School of Sports Sciences, University of Udine.
Since 2014 Head, Exercise Physiology Laboratory, Department of Medicine, University of Udine.
Since 2017 Coordinator, School of Medicine, University of Udine.
Since 2022 Director, Postgraduate School in Sports Medicine, University of Udine.

### PERIODS OF RESEARCH ABROAD

1992 *Research Assistant*, Dept. Physiologie, Universitè de Genève, Geneva (Switzerland) - (Prof. Paolo Cerretelli).
1993-1994 *Visiting Scientist*, Division of Physiology, Department of Medicine, University of California at San Diego, La Jolla, CA (USA) – (Prof. Peter D. Wagner).
1996-1997 *Postgraduate Researcher*, Division of Physiology, Department of Medicine, University of California at San Diego, La Jolla, CA (USA) – (Prof. Peter D. Wagner).

1998, 1999, 2000, 2001, 2002, 2004, 2005, 2009, 2016 V*isiting Scientist*, Dept. Health and Human Performance, Auburn University, Auburn, AL (USA) (Prof. L.B. Gladden).
2015, *Visiting Professor*, Universidade Federal de Santa Catarina, Florianopolis, Santa Catarina, Brasil.
2022, *Visiting Professor*, Faculty Health Sciences, Jagiellonian University Medical College, Krakow, Poland.

**PARTICIPATION TO INTERNATIONAL SCIENTIFIC EXPEDITIONS**
1987, 1988 Siracusa (Italy): Physiological adaptations in elite breath-hold divers,
1989 Bipindi (Camerun): Energetics of locomotion in African pygmees.
1990, 1991 Ev-K2-CNR Scientific Expeditions, "Pyramid" Laboratory, Lobuche, Khumbu (Nepal): Aerobic and anaerobic energy metabolism at high altitude.
2007, 2008 Orthopedic Hospital, Valdoltra (Slovenia): Physiological adaptations to simulated microgravity (bed rest). Italian Space Agency (ASI) Project OSMA (Osteoporosis and Muscular Atrophy) - ASI-OSMA.
2012, 2013 Planica Sports Center, Ratece (Slovenia): Physiological adaptations to simulated microgravity (bed rest) and hypoxia. Research Project: "Planetary Habitat Simulation – PlanHab". (VII Framework Programme, European Community, Bruxelles).
2012 Orthopedic Hospital, Valdoltra (Slovenia): Physiological adaptations to simulated microgravity (bed rest) in the elderly. Research Project: Physical activity and nutrition for quality ageing (PANGeA). Interreg-EU Projects.
2019 Bolnišnica Hospital, Izola (Slovenia): Effects of simulated microgravity (bed rest) on skeletal muscle oxidative metabolism. Research Project: "Marcatori biologici e funzionali per la biomedicine astronautica di precisione. MARS-PRE". Italian Space Agency (Agenzia Spaziale Italiana, ASI).

**HONORS**
Since 2016 Fellow, American College of Sports Medicine (FACSM)
Since 2021 Fellow, American Physiological Society (FAPS)

**RESEARCH ACTIVITY**
**General fields of interest:**
Exercise and environmental physiology, skeletal muscle bioenergetics, clinical physiology.
**Specific fields of interest:**
- Skeletal muscle oxidative metabolism during exercise; mechanisms of regulation; effects of training, inactivity, hypoxia, aging, pathological conditions.
- Functional evaluation of oxidative metabolism during exercise in humans, with specific reference to skeletal muscle: oxygen uptake kinetics, near-infrared spectroscopy, mitochondrial respiration by high-resolution respirometry in permeabilized skeletal muscle fibers; vascular peripheral and microvascular function.
- Physiological adjustments to exercise and functional evaluation of skeletal muscle oxidative metabolism in elderly, heart transplant recipients, patients with chronic heart failure, transgenic mice models of cardiomyopathy, patients with metabolic myopathies, obese patients. Effects of training and other interventions.
- Effects of simulated microgravity and inactivity (bed rest) on skeletal muscle oxidative metabolism; effects of microgravity associated with hypoxia.
- Physiological adjustments and adaptations to exercise in chronic hypobaric hypoxia.

Since 1999: Supervisor of 19 PhD students.

**MAIN SCIENTIFIC COLLABORATIONS**
- Institute of Biomedical Technologies, National Research Council, Milano, Italy (Dr. M. Marzorati).
- Dept. Electronics, Informatics and Bioengineering, Politecnico of Milano, Italy (Prof. A. Aliverti).
– Laboratory of Ergonomy, Italian Auxological Institute, Milano and Piancavallo, Italy (Prof. A. Sartorio).
- Dept. of Biomedical Science, University of Padua, Italy (Prof. M.V. Narici).

- Dept. of Molecular Medicine, University of Pavia, Italy (Prof. R. Bottinelli, Prof. M.A. Pellegrino, Prof. S. Porcelli).
- Faculty of Health Sciences, Jagiellonian University Medical College, Krakow, Poland (Prof. J.A. Zoladz).
- Institute for Kinesiology Research, Science and Research Center, Koper, Slovenia (Prof. R. Pišot).
- Dept. of Kinesiology, Auburn University, Auburn (Alabama), USA (Prof. L.B. Gladden).
- Dept. of Medicine, University of California San Diego, La Jolla (California), USA (Prof. M.C. Hogan).
- Division of Respiratory and Critical Care Physiology & Medicine, Harbor UCLA Medical Center, Torrance (California), USA (Prof. H.B. Rossiter).
- Dept. of Automation, Biocybernetics and Robotics, Jozef Stefan Institute, Ljubjana, Slovenia (Prof. I.B. Mekjavic).

**MAIN FUNDING RECEIVED FOR RESEARCH**

1998-2001. *Project Coordinator*. Collaborative Research Grant no. 972111, N.A.T.O., Bruxelles. Research Project: "Factors limiting muscle $O_2$ uptake on-kinetics". Funding: 5500 €.

1999-2001. *Principal Investigator*. Telethon Research Grant no. 1161 C: "$V'O_2$ kinetics for functional evaluation of myopathy patients", Telethon Foundation, Italy. Funding: 66.000 €.

2001-2005. *Scientific Coordinator of a Research Unit*. Research Project: "Physical frailty and loss of functional independence in old age: determinants and adaptations to physical activity". EC Contract n. QLK6-CT-2001-00323, V Framework Programme, European Community, Bruxelles. Total funding: 1.602.561 €. Funding for the Research Unit: 186720 €.

2002-2005. *Project Coordinator*. Collaborative Linkage Grant no. LST.CLG.979220, N.A.T.O., Bruxelles. Research Project: "Skeletal muscle $V'O_2$ kinetics: from basic physiology to exercise performance". Funding: 19200 €.

2004-2006. *Principal Investigator*. Telethon – UILDM Project (GUP030534), Italy. "New tools of functional evaluation of patients with metabolic myopathies". Funding: 73975 €.

2006-2008. *Principal Investigator WorkPackage 1B32.* Italian Space Agency (ASI) Project OSMA (Osteoporosis and Muscular Atrophy) - ASI-OSMA Contract I/007/06/0. "Functional evaluation of skeletal muscle oxidative metabolism in microgravity-induced muscular atrophy". Funding: 140000 €.

2009-2011. *Coordinator.* Telethon – UILDM Project (GUP08007), Italy. "New methods of functional evaluation of patients with metabolic myopathies. The effects of exercise training". Funding: 117800 €.

2011-2014. *Participant to a Research Unit.* Research Project: Physical activity and nutrition for quality ageing (PANGeA). Interreg-EU Projects. Total funding: 1253000 €. Funding for the Research Unit: 139000 €.

2012-2014. *Scientific Coordinator of a Research Unit.* Research Project: "Planetary Habitat Simulation – PlanHab". (EC Contract n. 284438, VII Framework Programme, European Community, Bruxelles; FP7-SPACE-2011-1. Total funding: 1878973 €. Funding for the Research Unit: 203064 €.

2013-2016. *Scientific Coordinator of the Italian Partners of the Project.* Ministry for University and Research, Warsaw, Poland. Research Project: "The effect of endurance training on skeletal muscle adaptive responses in transgenic mice (Tg$\alpha$q*44) with dilated cardiomyopathy". Funding for the Research Unit: 79000 €.

2013-2017. *Participant to a Research Unit.* Ministry of Health, Italy. Progetti di Ricerca Finalizzata - Young Researchers, no. GR-2011-02348868. Research Project: "Exercise tolerance in patients with late-onset Pompe disease on enzyme replacement therapy: effects of exercise training and hyperproteic diet." Funding for the Research Unit: 35600 €.

2017-2019. Co-funding for a post-doctoral fellowship. Istituto Auxologico Italiano, Milano. Project "Respiratory limitations to exercise tolerance in obese adolescents". 19200 €.

2019-2022. *Coordinator of a Research Unit*. PRIN Project (Italian Ministry of University and Research) 2017CBF8NJ, "Neuromuscular ageing: mechanisms and functional implications – NeuAge)". Total funding: 816860 €. Funding for the Research Unit: 108120 €.

2019-2022. *Coordinator of a Research Unit.* Research Project: "Marcatori biologici e funzionali per la biomedicine astronautica di precisione. MARS-PRE". Italian Space Agency (Agenzia

Spaziale Italiana, ASI; Bando ASI DC-VUM-2017-006, Biomedicina). Total funding: 1496000 €. Funding for the Research Unit: 80000 € .

2022-2025. *Coordinator of a Research Unit*. PRIN 2020 Project (Italian Ministry of University and Research) 2020EM9A8X, "Inactivity-induced neuromuscular impairment through different ages: from children, to young and middle age adults [InactivAge])". Total obtained funding: 756931 €. Obtained funding for the Research Unit: 189688 €.

**TOTAL OBTAINED FUNDING FOR RESEARCH**: about 1.500.000 €.

**PARTICIPATION TO TOPICAL TEAMS ETC.**

Since 2020. Member. European Space Agency (ESA) Topical Team on: "Pathophysiology, risk and clinical presentation of venous thromboembolism (VTE) and evaluation of its prevention, diagnosis, mitigation and management strategies in spaceflight".

2020-2022. Member. Tavolo Tematico Fisiologia Integrata (Cardiovascular Section). Italian Space Agency.

**EDITORIAL ACTIVITY**

***Editorial Board:***

Journal of Physiology (Reviewing Editor)
Medicine and Science in Sports and Exercise (Associate Editor)

***Guest Referee*:**

Journal of Applied Physiology, American Journal of Physiology (Heart and Circulatory Physiology); American Journal of Physiology (Regulatory, Integrative and Comparative Physiology); European Journal of Applied Physiology; Journal of Biomedical Optics; Experimental Physiology; Sports Medicine; Respiratory Physiology and Neurobiology; Circulation; Clinical Physiology and Functional Imaging; Acta Physiologica Scandinavica; Comprehensive Physiology; High Altitude Medicine and Biology; Scientific Reports.

**PUBLICATIONS**

153 publications on peer-reviewed international scientific journals.
Google Scholar: June 2023, H-index = 55, total number of citations = 10023; Scopus: November 2022: H-index 43, total number of citations = 6469.
32 chapters in books; 69 invited lectures; 189 communications to congresses.

**RECENT SELECTED PUBLICATIONS**


Porcelli S., M. Marzorati, F. Lanfranconi, P. Vago, R. Pišot, **B. Grassi**. Role of skeletal muscle impairment and brain oxygenation in limiting oxidative metabolism during exercise after bed rest. *J. Appl. Physiol.* 109: 101-111, 2010.

**Grassi B.**, H.B. Rossiter, M.C. Hogan, R.A. Howlett, J.E. Harris, M.L. Goodwin, J.L. Dobson, L.B. Gladden. Faster $O_2$ uptake kinetics in canine skeletal muscle *in situ* after acute creatine kinase inhibition. *J. Physiol.* 589: 221-233, 2011.

Jones A.M., **B. Grassi**, P.M. Christensen, P. Krustrup, J. Bangsbo, D.C. Poole. The slow component of $V'O_2$ kinetics: mechanistic bases and practical applications. *Med. Sci. Sports Exerc.* 43: 2046-2062, 2011.

Salvadego D., S. Lazzer, M. Marzorati, S. Porcelli, E. Rejc, B. Šimunic, R. Pišot, P.E. di Prampero, **B. Grassi**. Functional impairment of skeletal muscle oxidative metabolism during knee-extension exercise after bed rest. *J. Appl. Physiol.* 111: 1719-1726, 2011.

Rejc E., P.E. di Prampero, S. Lazzer, **B. Grassi**, B. Šimunic, R. Pišot, G. Antonutto, M. Narici. Maximal explosive power of the lower limbs before and after 35 days of bed rest under different diet energy intake. *Eur. J. Appl. Physiol.* 115: 429-436, 2015.

Cannavino J., L. Brocca, M. Sandri, **B. Grassi**, R. Bottinelli, M.A. Pellegrino. The role of alterations in mitochondrial dynamics and PCG-1$\alpha$ over-expression in fast muscle atrophy following hindlimb unloading. *J. Physiol.* 593: 1981-1995, 2015.

**Grassi B.**, H.B. Rossiter, J.A. Zoladz. Skeletal muscle fatigue and decreased efficiency: two sides of the same coin? *Exerc. Sport Science Rev.* 43: 75-83, 2015.

Pišot R., U. Marusic, G. Biolo, S. Mazzucco, S. Lazzer, **B. Grassi**, C. Reggiani, L. Toniolo, P.E. di Prampero, A. Passaro, M. Narici, S. Mohammed, J. Rittweger, M. Gasparini, M. Gabrijelčič Blenkuš, B. Šimunič. Greater loss in muscle mass and function but smaller metabolic alterations in older compared to younger men following two weeks of bed rest and recovery. *J. Appl. Physiol.* 120: 922-929, 2016.

Salvadego D., M.E. Keramidas, L. Brocca, R. Domenis, I. Mavelli, J. Rittweger, O. Eiken, I.B. Mekjavic, **B. Grassi.** Separate and combined effects of a 10-d exposure to hypoxia and inactivity on oxidative function *in vivo* and mitochondrial respiration *ex vivo* in humans. *J. Appl. Physiol.* 121: 154-163, 2016.

**Grassi B.**, V. Quaresima. Near-infrared spectroscopy and skeletal muscle oxidative function *in vivo* in health and disease: a review from an exercise physiology perspective. *J. Biomed. Optics* 21 (9), 091313, 2016.

Porcelli S., M. Marzorati, L. Morandi, **B. Grassi**. Home-based aerobic exercise training improves skeletal muscle oxidative metabolism in patients with metabolic myopathies. *J. Appl. Physiol.* 121: 699-708, 2016.

Biolo G., R. Pišot, S. Mazzucco, F.G. Di Girolamo, R. Situlin, S. Lazzer, **B. Grassi**, C. Reggiani, A. Passaro, J. Rittweger, M. Gasparini, B. Šimunič, M. Narici. Anabolic resistance assessed by oral stable isotope ingestion following bed rest in young and older adult volunteers: relationship with changes in muscle mass. *Clin. Nutr.* 36: 1420-1426, 2017.

**Grassi B.**, J. Majerczak, E. Bardi, A. Buso, M. Comelli, S. Chlopicki, M. Guzik, I. Mavelli, Z. Nieckarz, D. Salvadego, U. Tyrankiewicz, T. Skórka, R. Bottinelli, J.A. Zoladz, M.A. Pellegrino. Exercise training in Tg$\alpha_q$*44 mice during the progression of chronic heart failure: cardiac *vs.* peripheral (soleus muscle) impairments to oxidative metabolism. *J. Appl. Physiol.* 123: 326-336, 2017.

Salvadego D., M.E. Keramidas, R. Kölegård, L. Brocca, S. Lazzer, I. Mavelli, J. Rittweger, O. Eiken, I.B. Mekjavic, **B. Grassi.** PlanHab*: hypoxia does not worsen the impairment of skeletal muscle oxidative function induced by bed rest alone. *J. Physiol.* 596: 3341-3355, 2018.

Zuccarelli L., S. Porcelli, L. Rasica, M. Marzorati, **B. Grassi.** Comparisons between slow components of HR and V'$O_2$ kinetics: functional significance. *Med. Sci. Sports Exerc.* 50: 1649-1657, 2018.

**Grassi B.** Bed rest studies as analogs of conditions encountered in space and diseases. *Med. Sci. Sports Exerc.* 50: 1907-1908, 2018.

**Grassi B.**, S. Porcelli, M. Marzorati. Translational medicine: exercise physiology applied to metabolic myopathies. *Med. Sci. Sports Exerc.* 51: 2183-2192, 2019.

Zuccarelli L., P.C. Do Nascimento Salvador, A. Del Torto, R. Fiorentino, **B. Grassi**. Skeletal muscle V'$O_2$ kinetics by the NIRS repeated occlusions method during the recovery from cycle ergometry exercise. *J. Appl. Physiol.* 128: 534-540, 2020.

Narici M., G. De Vito, M. Franchi, A. Paoli, T. Moro, G. Marcolin, **B. Grassi**, G. Baldassarre, L. Zuccarelli, G. Biolo, F.G. di Girolamo, N. Fiotti, F. Dela, P. Greenhaff, C. Maganaris. Impact of sedentarism due to the COVID-19 home confinement on neuromuscular, cardiovascular and metabolic health: Physiological and pathophysiological implications and recommendations for physical and nutritional countermeasures. *Eur. J. Sport Sci.* https://doi.org/10.1080/17461391.2020.1761076, 2020.

Zuccarelli L., G. Baldassarre, B. Magnesa, C. Degano, M. Comelli, M. Gasparini, G. Manferdelli, M. Marzorati, I. Mavelli, A. Pilotto, S. Porcelli, L. Rasica, B. Šimunič, R. Pišot, M. Narici, **B. Grassi.** Peripheral impairments of oxidative metabolism after a 10-day bed rest are upstream of mitochondrial respiration. *J. Physiol.* 599: 4813-4829, 2021.

Salvadego D., **B. Grassi**, M. Keramidas, O. Eiken, A. McDonnell, I. Mekjavic. Heterogeneity of human adaptations to bed rest and hypoxia: a retrospective analysis within the skeletal muscle oxidative function. *Am. J. Physiol. Reg. Int. Comp. Physiol.* 321: R813-R822, 2021.

Baldassarre G., L. Zuccarelli, G. Manferdelli, V. Manfredini, M. Marzorati, A. Pilotto, S. Porcelli, L. Rasica, B. Šimunič, R. Pišot, M. Narici, **B. Grassi**. Decrease in work rate in order to keep a constant heart rate: biomarker of exercise intolerance following a 10-day bed rest. *J. Appl. Physiol.* 132: 1569-1579, 2022.

D'Amuri A., J.M. Sanz, S. Lazzer, R. Pišot, B. Šimunič, G. Biolo, G. Zuliani, M. Gasparini, M. Narici, **B. Grassi**, C. Reggiani, E. Dalla Nora, A. Passaro. Irisin attenuates muscle impairment during bed rest through muscle-adipose tissue crosstalk. *Biology* (Basel): 11 (7): 999, 2022.

Sturm G., K.R. Karan, A. Monzel, B.S. Santhanam, T. Taivassalo, C. Bris, S.A. Ware, M. Cross, A. Towheed, A. Higgins-Chen, M.J. McManus, A. Cardenas, J. Lin, E.S. Epel, S. Rahman, J. Vissing, **B. Grassi**, M. Levine, S. Horvath, R.G. Haller, G. Lenaers, D.C. Wallace, M.-P. St-Onge, S. Tavazoie, V. Procaccio, B.A. Kaufman, E.L. Seifert, M. Hirano, M. Picard. OxPhos defects cause hypermetabolism and reduce lifespan in cells and in patients with mitochondrial diseases**.** *Communications Biology* 6: 22, 2023. https://doi.org/10.1038/s42003-022-04303-x.

Weber T., K. Harris, R. Arya, A. Elias, D.C. Green, D. Greaves, L. Petersen, L. Roberts, T. Kamine, L. Mazzolai, A. Bergauer, D. Kim, R.O. Engberink, P. zu Eulenburg, **B. Grassi**, L. Zuccarelli, G. Baldassarre, K. Tabury, S. Baatout, J. Jordan, A. Blaber, A. Choukér, T. Russomano, N. Goswami. Pathophysiology, Risk, Diagnosis, and Management of Venous Thrombosis in Space: Where are we now? *NPJ Microgravity* 16; 9 (1), 17, 2023.

According to law 679/2016 of the Regulation of the European Parliament of 27th April 2016, I hereby express my consent to process and use my data provided in this CV.

Udine, June 12th 2023

(Prof. Bruno Grassi)