

## François HUG

Full Professor

Université Côte d'Azur (France)

**Date of birth:** 20/07/1978 (44 years old)

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## Short biography and research topics

I received my PhD in human movement sciences from *Aix-Marseille Université* (France, 2003). I have been **Full Professor** at *Nantes Université* (France), where I **led a research Lab** until I moved to *Université Côte d'azur* (France), in 2021. In addition to two sabbatical periods at the University of Queensland (2011 & 2019), I was offered a 3-year position as a Principal Research Fellow position at the same university (2013-2015). I was awarded a **prestigious IUF fellowship** (2017-2022; [https://en.wikipedia.org/wiki/Institut\\_Universitaire\\_de\\_France](https://en.wikipedia.org/wiki/Institut_Universitaire_de_France)).

My research interest is at the nexus of **neurophysiology** and **biomechanics** (neuromechanics) to investigate the **control of movement** in health and disease (>190 articles/chapters). My recent achievements are notable for the demonstration that we each have a **muscle activation signature** that, like our face or fingerprints, is unique to us (results highlighted in the *New York Times*). Recently, I have developed a **neural framework** to reveal synergies at the spinal motor neuron level, which has important implications for advancing our understanding of the control of movement. My **multidisciplinary** approach to study human movement required mobility across thematic areas: **1)** lead work at the nexus of **biology** and **physics**, e.g. to estimate muscle elasticity using elastography (>40 articles); **2)** work with **clinical scientists**, e.g. to provide insights into altered motor control in **musculoskeletal pain** (>25 articles); **3)** Lead **discovery science**, to decode motor neuron activity from high-density electromyography and provide insights into the control of movement (>10 articles since 2021).

## Current positions

Since 2021 **Professor (full)** – Univ. Côte d'Azur, France

Since 2021 **Coordinator** of the PhD program in Human Movement Sciences (20-25 students)

Since 2015 **Honorary Professor** – Univ. of Queensland, Australia

## Past positions

2019 (1 year) Visiting academic – Univ. of Queensland, Australia

2017 – 2021 **Lab head** (> 50 members) – Nantes Univ, France

2014 – 2021 Professor (full) – Faculty of Sports Sciences, Nantes Univ, France

2013 – 2018 (5 x 1 week) Visiting researcher – Hong Kong Polytechnic Univ., Hong Kong

2013 – 2015 (3 years) **Principal Research Fellow** – Univ. of Queensland, Australia

2011 (8 months) Visiting academic – Univ. of Queensland, Australia

2006 – 2014 A/Prof – Faculty of Sports Sciences, Nantes Univ, France

2005 – 2006 Research Fellow – National Institute of Sports (INSEP), France

2004 – 2005 Post-doctoral Fellow – Univ. Paris VI, France

## Education

**2003** **PhD** in Human Movement Sciences – Univ. Aix-Marseille II, France

**2001** **Master of Science** in Human Movement Sciences – Univ. Aix-Marseille II, France

**1999** **Bachelor** in Sport Sciences – Univ. Paris XI (Orsay), France

# 1- Research activities

Publications	
Number of articles in peer-reviewed journals	187 (70 in the last 5 years)
Percentage of publications as <b>first author</b>	23%
Percentage of publications as <b>last author</b>	24%
Number of <b>invited reviews</b>	5
Highest <b>impact factors</b>	41.8 - Intensive Care Medicine 13.1 - Journal of Sport and Health Science 11.9 - Sports Medicine 7.0 - The American Journal of Sport Medicine 6.7 - Journal of Neuroscience 6.6 - Exercise and Sport Science Reviews (x 2) 6.3 - Med & Sci in Sport and Exercise (x 11) 6.2 - Journal of Physiology – London (x 3) 5.5 - Proceedings of the Royal Society B 5.4 – Journal of Neural Engineering (x 2)
Number of <b>books/book chapters</b>	1/4
<b>H index</b> (Google scholar, May 2023)	54
Number of <b>citations</b> (Google scholar, May 2023)	9381

## 10 representative publications:

Del Vecchio A, Germer C, Kinfe T, Nuccio S, **Hug F**, Eskofier B, Farina D, Enoka R. The forces generated by agonist muscles arise from motor unit synergies. J Neurosci. 2023 19;43(16):2860-2873.

**Hug F**, Avrillon S, Ibanez J, and Farina D. Common Synaptic Input, Synergies, and Size Principle: Control of Spinal Motor Neurons for Movement Generation (topical review). J Physiol. 2023. 601(1):11-20.

Dick TJM, **Hug F**. Advances in imaging for assessing the design and mechanics of skeletal muscle in vivo. J Biomech. 2023 May 16;155: 111640. (Invited review for the ISB 50<sup>th</sup> birthday issue)

**Hug F**, Avrillon S, Sarcher A, Del Vecchio A, and Farina D. Correlation networks of spinal motor neurons that innervate lower limb muscles during a multi-joint isometric task. J Physiol 2022.

**Hug F**, Del Vecchio A, Avrillon S, Farina D, and Tucker K. Muscles from the same muscle group do not necessarily share common drive: evidence from the human triceps surae. J Appl Physiol (1985) 130: 342-354, 2021.

Aeles J, Horst F, Lapuschkin S, Lacourpaille L, and **Hug F**. Revealing the unique features of each individual's muscle activation signatures. J R Soc Interface 18: 20200770, 2021.

**Hug F**, Vogel C, Tucker K, Dorel S, Deschamps T, Le Carpentier E, and Lacourpaille L. Individuals have unique muscle activation signatures as revealed during gait and pedaling. J Appl Physiol (1985) 127: 1165-1174, 2019.

Lacourpaille L, Nordez A, and **Hug F**. The nervous system does not compensate for an acute change in the balance of passive force between synergist muscles. J Exp Biol 220: 3455-3463, 2017.

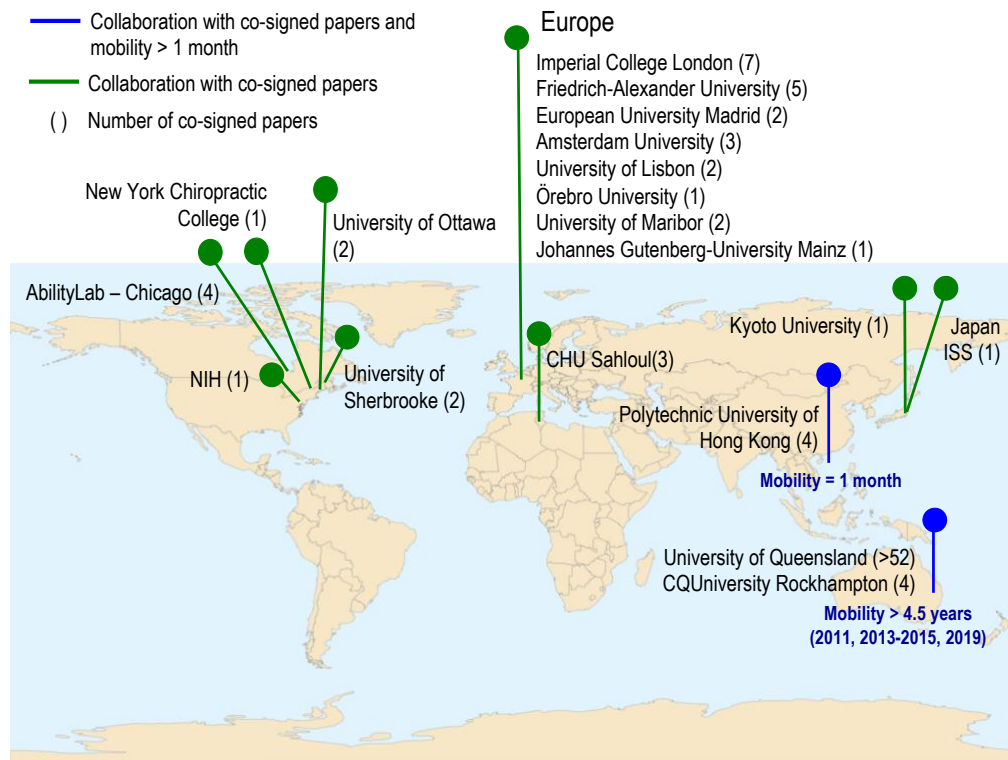
**Hug F**, Goupille C, Baum D, Raiteri BJ, Hodges PW, and Tucker K. Nature of the coupling between neural drive and force-generating capacity in the human quadriceps muscle. Proc Biol Sci 282: 2015.

Schmidt M, Kindler F, Gottfried SB, Raux M, **Hug F**, Similowski T, and Demoule A. Dyspnea and surface inspiratory electromyograms in mechanically ventilated patients. Intensive Care Med 39: 1368-1376, 2013.

--- Full list of publications available at the end of this document ---

## International collaborations

Below are my **major international collaborations**:



## Awards

2017-2022	<b>Junior Fellow - Institut Universitaire de France (IUF)</b> , Paris, France <2% of French university Professors have been distinguished by IUF
2016-2022	Scientific Excellence Award
2021	Recipient of the Equipment Donation Initiative, De Luca Foundation, USA
2018	Travel fellowship, French Society of Biomechanics
2018	Runner-Up Best Paper Prize 2017, Journal of Anatomy
2012 & 2014	Certificate of excellence in reviewing, <i>J Biomechanics</i> / <i>J Electromyography Kinesiology</i>
2009-2013	Scientific Excellence Award
2010	<b>Best Basic Research Award</b> , ISEK conference, Aalborg, Denmark

## Supervision

- More than 30 master students
- 3 Honours students (Univ of Queensland)
- **14 PhD students** as detailed in the table below

Name	Nationality/ University	# PhD-related articles	Start	Duration (months)	Current position
Nicolas Turpin	French Nantes Univ.	6	2008	40	A/Prof Université de la Réunion
Killian Bouillard	French Nantes Univ.	8	2010	40	-
Joao Vaz	Portuguese Univ. Lisbon	1	2012	40	A/Prof Lisboa Universidad
Lilian Lacourpaille	French Nantes Univ.	7	2011	36	A/Prof Nantes Université

Wolbert van den Hoorn	Dutch Univ. Queensland	2	2012	60	Post-doc fellow QUT
Niels-Peter Brochner Nielsen	Danish Nantes Univ.	3	2013	40	Clinical research assistant
Simon Avrillon	French Univ. Paris Orsay	3	2015	40	Post-doc fellow Imperial College London
Marion Crouzier	French Nantes Univ.	3	2016	40	Lecturer Nantes Université
Iris Sachet	French Nantes Univ.	1	2017	45	Sport Scientist French Federation
Jean Maillet	French Nantes Univ.	2	2019	39	-
Nicole Kelp	American Univ. Queensland	1	2019	Ongoing	-
Raphaël Hamard	French Nantes Univ.	2	2019	42	Visiting researcher The University of Queensland
Julien Rossato	French Nantes Univ.	1	2019	Ongoing	-
François Démoncourt	French Univ. Côte d'Azur	0	2022	Ongoing	-

### Research grants

>4.5 M€ (~>7 M in \$AUS) including >940,000 € as principal investigator [1 EUR = ~1.5 \$AUS]

#### Current national grants:

2019-2023 249,200 €	French National Research Agency (ANR-19-CE17-2) – Chief Investigator A Individual muscle coordination strategies and their role in the development of MSK disorders
2021-2024 1 998,000 €	French National Research Agency (20-STHP-0006) – Associate Investigator High performance in cycling and rowing – Program “Paris 2024” (THPCA)
2020-2023 1 890,000 €	French National Research Agency (ANR-19-STHP-3) – Associate Investigator Injury prevention – Program “Paris 2024” (FULGUR)
2019-2023 469,000 €	French National Research Agency (ANR-19-CE19-17) – Associate investigator Innovations in elastography to quantify Viscosity and Anisotropy of muscle

#### Previous grants:

Acronym	Funding body	Period	Chief Investigator(s)	My role	Amount (€ or AU\$)
In Australia					
OA_STUDY	University of Queensland	2019	M. Smith	AI	\$30 k
RIBG-SWE	CQ University	2016	L. Heales	AI	\$120 k
NSRG	CQ University	2016	L. Heales	AI	\$15 k
--	RL Cooper Medical Research Foundation	2014	K. Tucker F. Hug	CIB	\$22 k
MEI-SSI	University of Queensland	2013	F. Hug	CIA	\$60 k

In France					
IUF-HUG	French University Institute	2017-2022	F. Hug	CI (fellowship)	75 k€
19r37	French National Institute (INSEP)	2019-2022	S. Dorel	AI	32 k€
17r04	French National Institute (INSEP)	2017-2019	F. Hug G. Guilhem	CIA	41,7 k€
14r23	French National Institute (INSEP)	2015-2019	S. Dorel	AI	40 k€
QUETE	Région Pays de la Loire	2015-2018	F. Hug A. Nordez	CIA	250 k€
Nerf-SSI	Université de Nantes	2017	F. Hug	CIA	16 k€
FED-Echo	Europea Union (FEDER program)	2010-2013	F. Hug A. Nordez	CIA	185,1 k€
ITAM-114597	French Association against Myopathies	2010-2012	F. Hug A. Nordez	CIA	80 k€
	ANTADIR post-doctoral fellowship	2004-2005	F. Hug	CIA	20 k€

### Commission of trust / Service to the research community

<b>2022-current</b>	<b>Editorial board</b> – Scandinavian Journal of Medicine and Science in Sport
<b>2009-current</b>	<b>Editorial board</b> – Journal of Electromyography and Kinesiology
2012-2017	Academic editor – PloS ONE (≈50 articles/year)
2012-2017	Associate editor – Frontiers in Exercise Physiology (≈6 articles/year)
2012-2015	Scientific committee for ACAPS, IcSports and ISEK conferences
2010-current	Reviewer for about 7 grant applications/year (including Austrian Sc. Fund, UK asthma, Estonian Sc. Found, RGC Hong Kong, Italian ministry of Health, FRS-FNRS [Belgium], ANR [France])
2004-current	Reviewer for about 20 articles/year

### Invited conferences / Organisation of scientific meetings

- **22 invited conferences** (16 international / 6 national), including **5 keynote lectures**
- 2019, Nantes - **Chair of an international workshop** “*Elastography for muscle biomechanics*”
- 2017, Brisbane - **Organisation of a tutorial** “*Ultrasound imaging for muscle*”
- 2014, Rome - **Organisation of a symposium** “*Neuromechanics of muscle coordination*”

### Scientific leadership

- **Elected member of the council of the International Society for Electrophysiology and Kinesiology** – involved in **Member Services Committee**
- **Expert for the Consensus for Experimental Design in Electromyography (CEDE) project**, which is an international initiative which aims to guide decision-making in recording, analysis, and interpretation of electromyographic data. This initiative includes 23 international experts – **5 papers have been published** since inception in 2020, with >200 citations.
- **Ranked 4<sup>th</sup>, 29<sup>th</sup>, 45<sup>th</sup> worldwide** for electromyography, skeletal muscle and elastography, respectively (expertscape.com, 03/2023) – **ranked 1<sup>st</sup> among French scientists** in each of these categories.
- **Named in the world’s top 2% of scientist list** (Baas et al., 2021, doi:10.17632/btchxktyzw.3)

## 2- Teaching activities

Teaching experience from 2006 to 2022		
Academic year	Nb hours (face-to-face)	Main subjects
2006-2007	192	- Neurophysiology of movement (BsC)
2007-2008	192	- Respiratory Physiology (BsC)
2008-2009	192	- Muscle plasticity (MsC)
2009-2010	192	- Muscle coordination (MsC)
2010-2011	192	
2011-2012	96 (6-month sabbatical)	
2012-2013	192	
2013-2014	0 (secondment at UQ)	
2014-2015	0 (secondment at UQ)	
2015-2016	0 (secondment at UQ)	
2016-2017	192	- Neurophysiology of movement (BsC)
2017-2018	64 (IUF fellowship)	- Muscle plasticity (MsC)
2018-2019	64 (IUF fellowship)	- Neuromechanics (MsC)
2019-2020	64 (IUF fellowship)	- Optimisation of muscle performance (MsC)
2020-2021	64 (IUF fellowship)	- MOOC 'Human Movement' (MsC)
2021-2022	64 (IUF* fellowship)	- Neurophysiology of movement (BsC)
2022-2023	192	- Posture and locomotion (MsC)
<b>Total</b>	<b>1952 hours</b>	

\* The IUF fellowship compensated my university for my teaching time

I have led **innovative pedagogic projects**:

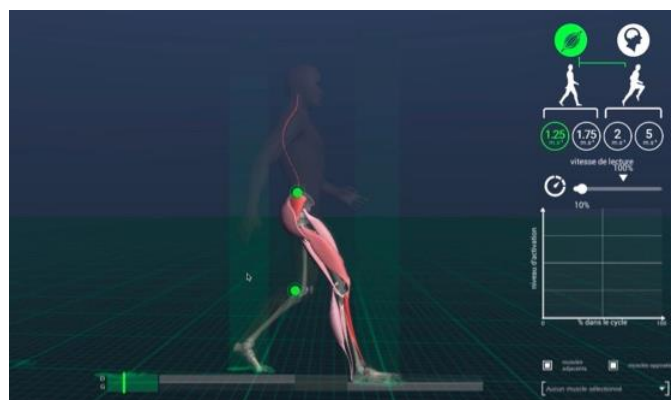
In 2017, I received funds to develop a **MOOC** (Massive Open Online Course) on human movement. This MOOC was opened in January 2019 and 2021 with **> 10,000 participants** in total. All videos available at: <https://www.youtube.com/channel/UCcgEgy8pRq7j1OWzoVsySdg>



I also received funds to co-develop an **open access 3-D educational resource** to present the neural control of movement.

Link to the resource:

<http://brule.co/lab/Neuro-marche/englishTempVersion/>



### 3- Service (educational and administrative responsibilities)

#### Administrative duties

At local level from 2021 to 2022 (Université Côte d'Azur, France):

2022-current	<b>Co-responsible of a research team</b> of the LAMHESS lab
2022-current	Member of the <b>steering committee</b> of UCA Sport
2021-current	<b>Responsible of the PhD program</b> "Human Movement Science"
2021-current	Member of the doctoral schools committee
2021-current	Member of the <b>steering committee</b> of the graduate school "Healthy"

At local level from 2017 to 2021 (Nantes Université, France):

2017-2021	<b>Lab head (elected);</b> >30 permanent researchers and > 20 PhD students
2018-2021	Member of the doctoral school council (ELICC)
2016-2021	Board member (elected) of the scientific committee of Nantes Université
2016-2021	Member of the scientific committee of the Faculty of Sports Sciences
2015-2021	Member (elected) of the council of the Faculty of Sports Sciences

At national level:

2017 – Current	Member of >10 selection committees for assistant and professor positions
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At international level:

2022-current	Member (elected) of the council of <i>the International Society of Electrophysiology and Kinesiology</i> – ISEK
2015	Member of a selection committee for a post doc position, The University of Queensland

#### Pedagogic duties

2016 – 2021	Coordinator of the Master degree "Training & Optimisation of Sports Performance" Faculty of Sports Sciences, Nantes Université, France
2008 – 2012	Coordinator of the Bachelor degree "Sport training" Faculty of Sports Sciences, Nantes Université, France

## 4- Annex

### Articles in peer-reviewed journals

Dick TJM, **Hug F**. Advances in imaging for assessing the design and mechanics of skeletal muscle in vivo. *J Biomech*. 2023 May 16;155: 111640. doi: 10.1016/j.jbiomech.2023.111640.

Kelp NY, Clemente CJ, Tucker K, **Hug F**, Pinel S, Dick TJM. Influence of internal muscle properties on muscle shape change and gearing in the human gastrocnemii. *J Appl Physiol* (1985). 2023 May 11. doi: 10.1152/jappphysiol.00080.2023.

Tier L, Salomoni SE, **Hug F**, Besomi M, Hodges PW. Adaptability of the load sharing between the longissimus and components of the multifidus muscle during isometric trunk extension in healthy individuals. *Eur J Appl Physiol*. 2023 Apr 20. doi: 10.1007/s00421-023-05193-5.

Del Vecchio A, Germer C, Kinfe T, Nuccio S, **Hug F**, Eskofier B, Farina D, Enoka R. The forces generated by agonist muscles arise from motor unit synergies. *J Neurosc*. 2023. In press.

Crouzier M, **Hug F**, Sheehan F, Collins NJ, Crosley K, Tucker K. Neuromechanical properties of the vastus medialis and lateralis in adolescents with patellofemoral pain. *Ortho J Sports Med*. In press.

Martinez-Valdes E, Enoka RM, Holobar A, McGill K, Farina D, Besomi M, **Hug F**, Falla D, Carson RG, Clancy EA, Disselhorst-Klug C, van Dieën JH, Tucker K, Gandevia S, Lowery M, Sogaard K, Besier T, Merletti R, Kiernan MC, Rothwell JC, Perreault E, Hodges PW. Consensus for experimental design in electromyography (CEDE) project: Single motor unit matrix. *J Electromyogr Kinesiol*. 2023 Feb; 68:102726.

Aeles J, Sarcher A, **Hug F**. Common synaptic input between motor units from the lateral and medial posterior soleus compartments does not differ from that within each compartment. *J Appl Physiol* (1985). 2023 Jan 1;134(1):105-115.

Wen Y, Kim SJ, Avrillon S, Levine JT, **Hug F**, Pons JL. Toward a generalizable deep CNN for neural drive estimation across muscles and participants. *J Neural Eng*. 2023 Jan 18;20(1).

**Hug F**, Avrillon S, Ibanez J, and Farina D. Common Synaptic Input, Synergies, and Size Principle: Control of Spinal Motor Neurons for Movement Generation. *J Physiol*. 2022. In press.

Wen Y, Sangjoon K, Avrillon S, Levine J, **Hug F** and Pons J. A deep CNN framework for neural drive estimation from HD-EMG across contraction intensities and joint angles. *IEEE Trans Neural Sys & Rehab Eng*, 30, 2950, 2022.

Sachet I, Brochner Nygaard NP, Guilhem G, **Hug F**, and Dorel S. Strength capacity of lower-limb muscles in world-class cyclists: new insights into the limits of sprint cycling performance. *Sports Biomech* 1-18, 2022.

Rossato J, Tucker K, Avrillon S, Lacourpaille L, Holobar A, and **Hug F**. Less common synaptic input between muscles from the same group allows for more flexible coordination strategies during a fatiguing task. *J Neurophysiol* 127: 421-433, 2022.

Maillet J, Rossi J, **Hug F**, Proquez JJ, and Nordez A. Influence of experience on kinematics of upper limbs during sewing gesture. *Appl Ergon* 102: 103737, 2022.

Maillet J, Avrillon S, Nordez A, Rossi J, and **Hug F**. Handedness is associated with less common input to spinal motor neurons innervating different hand muscles. *J Neurophysiol* 2022.

**Hug F**, Avrillon S, Sarcher A, Del Vecchio A, and Farina D. Correlation networks of spinal motor neurons that innervate lower limb muscles during a multi-joint isometric task. *J Physiol* 2022.

Hamard R, **Hug F**, Kelp NY, Feigean R, Aeles J, and Dick TJM. Inclusion of image-based in vivo experimental data into the Hill-type muscle model affects the estimation of individual force-sharing strategies during walking. *J Biomech* 135: 111033, 2022.

Goreau V, Pigne R, Bernier N, Nordez A, **Hug F**, and Lacourpaille L. Hamstring muscle activation strategies during eccentric contractions are related to the distribution of muscle damage. Scand J Med Sci Sports 32: 1335-1345, 2022.

Gallina A, Disselhorst-Klug C, Farina D, Merletti R, Besomi M, Holobar A, Enoka RM, **Hug F**, Falla D, Sogaard K, McGill K, Clancy EA, Carson RG, van Dieen JH, Gandevia S, Lowery M, Besier T, Kiernan MC, Rothwell JC, Tucker K, and Hodges PW. Consensus for experimental design in electromyography (CEDE) project: High-density surface electromyography matrix. J Electromyogr Kinesiol 64: 102656, 2022.

Cheng R, Crouzier M, **Hug F**, Tucker K, Juneau P, McCreedy E, Gandler W, McAuliffe MJ, and Sheehan FT. Automatic quadriceps and patellae segmentation of MRI with cascaded U(2) -Net and SASSNet deep learning model. Med Phys 49: 443-460, 2022.

Andrade RJ, Freitas SR, **Hug F**, Coppieters MW, Sierra-Silvestre E, and Nordez A. Spatial variation in mechanical properties along the sciatic and tibial nerves: An ultrasound shear wave elastography study. J Biomech 136: 111075, 2022.

Aeles J, Bolsterlee B, Kelp NY, Dick TJM, and **Hug F**. Regional variation in lateral and medial gastrocnemius muscle fibre lengths obtained from diffusion tensor imaging. J Anat 240: 131-144, 2022.

Xu J, Fu SN, and **Hug F**. Age-related increase in muscle stiffness is muscle length dependent and associated with muscle force in senior females. BMC Musculoskelet Disord 22: 829, 2021.

Wen Y, Avrillon S, Hernandez-Pavon JC, Kim SJ, **Hug F**, and Pons JL. A convolutional neural network to identify motor units from high-density surface electromyography signals in real time. J Neural Eng 18: 2021.

Tier L, Salomoni SE, **Hug F**, Besomi M, and Hodges PW. Shear modulus of multifidus and longissimus muscles measured using shear wave elastography correlates with muscle activity, but depends on image quality. J Electromyogr Kinesiol 56: 102505, 2021.

Pinel S, Kelp NY, Bugeja JM, Bolsterlee B, **Hug F**, and Dick TJM. Quantity versus quality: Age-related differences in muscle volume, intramuscular fat, and mechanical properties in the triceps surae. Exp Gerontol 156: 111594, 2021.

McManus L, Lowery M, Merletti R, Sogaard K, Besomi M, Clancy EA, van Dieen JH, **Hug F**, Wrigley T, Besier T, Carson RG, Disselhorst-Klug C, Enoka RM, Falla D, Farina D, Gandevia S, Holobar A, Kiernan MC, McGill K, Perreault E, Rothwell JC, Tucker K, and Hodges PW. Consensus for experimental design in electromyography (CEDE) project: Terminology matrix. J Electromyogr Kinesiol 59: 102565, 2021.

Kelp NY, Gore A, Clemente CJ, Tucker K, **Hug F**, and Dick TJM. Muscle architecture and shape changes in the gastrocnemii of active younger and older adults. J Biomech 129: 110823, 2021.

**Hug F**, Del Vecchio A, Avrillon S, Farina D, and Tucker K. Muscles from the same muscle group do not necessarily share common drive: evidence from the human triceps surae. J Appl Physiol (1985) 130: 342-354, 2021.

**Hug F**, Avrillon S, Del Vecchio A, Casolo A, Ibanez J, Nuccio S, Rossato J, Holobar A, and Farina D. Analysis of motor unit spike trains estimated from high-density surface electromyography is highly reliable across operators. J Electromyogr Kinesiol 58: 102548, 2021.

Hodges PW, Butler J, Tucker K, MacDonell CW, Poortvliet P, Schabrun S, **Hug F**, and Garland SJ. Non-uniform Effects of Nociceptive Stimulation to Motoneurons during Experimental Muscle Pain. Neuroscience 463: 45-56, 2021.

Hamard R, Aeles J, Kelp NY, Feigean R, **Hug F**, and Dick TJM. Does different activation between the medial and the lateral gastrocnemius during walking translate into different fascicle behavior? J Exp Biol 224: 2021.

Germer CM, Farina D, Elias LA, Nuccio S, **Hug** F, and Del Vecchio A. Surface EMG cross talk quantified at the motor unit population level for muscles of the hand, thigh, and calf. J Appl Physiol (1985) 131: 808-820, 2021.

Boyer A, **Hug** F, Avrillon S, and Lacourpaille L. Individual differences in the distribution of activation among the hamstring muscle heads during stiff-leg Deadlift and Nordic hamstring exercises. J Sports Sci 39: 1830-1837, 2021.

Besomi M, Salomoni SE, **Hug** F, Tier L, Vicenzino B, and Hodges PW. Exploration of shear wave elastography measures of the iliotibial band during different tasks in pain-free runners. Phys Ther Sport 50: 121-129, 2021.

Besomi M, Nava GTA, van den Hoorn W, **Hug** F, Vicenzino B, and Hodges PW. Influence of transducer orientation on shear wave velocity measurements of the iliotibial band. J Biomech 120: 110346, 2021.

Avrillon S, Del Vecchio A, Farina D, Pons JL, Vogel C, Umehara J, and **Hug** F. Individual differences in the neural strategies to control the lateral and medial head of the quadriceps during a mechanically constrained task. J Appl Physiol (1985) 130: 269-281, 2021.

Aeles J, Horst F, Lapuschkin S, Lacourpaille L, and **Hug** F. Revealing the unique features of each individual's muscle activation signatures. J R Soc Interface 18: 20200770, 2021.

Vaidya T, Thomas-Ollivier V, **Hug** F, Bernady A, Le Blanc C, de Bisschop C, and Chambellan A. Translation and Cultural Adaptation of PROactive Instruments for COPD in French and Influence of Weather and Pollution on Its Difficulty Score. Int J Chron Obstruct Pulmon Dis 15: 471-478, 2020.

Lindemann I, Coombes BK, Tucker K, **Hug** F, and Dick TJM. Age-related differences in gastrocnemii muscles and Achilles tendon mechanical properties in vivo. J Biomech 112: 110067, 2020.

Goo M, Johnston LM, **Hug** F, and Tucker K. Systematic Review of Instrumented Measures of Skeletal Muscle Mechanical Properties: Evidence for the Application of Shear Wave Elastography with Children. Ultrasound Med Biol 46: 1831-1840, 2020.

Crouzier M, Tucker K, Lacourpaille L, Doguet V, Fayet G, Dauty M, and Hug F. Force-sharing within the Triceps Surae: An Achilles Heel in Achilles Tendinopathy. Med Sci Sports Exerc 52: 1076-1087, 2020.

Besomi M, Hodges PW, Clancy EA, Van Dieen J, **Hug** F, Lowery M, Merletti R, Sogaard K, Wrigley T, Besier T, Carson RG, Disselhorst-Klug C, Enoka RM, Falla D, Farina D, Gandevia S, Holobar A, Kiernan MC, McGill K, Perreault E, Rothwell JC, and Tucker K. Consensus for experimental design in electromyography (CEDE) project: Amplitude normalization matrix. J Electromyogr Kinesiol 53: 102438, 2020.

Avrillon S, Lacourpaille L, **Hug** F, Le Sant G, Frey A, Nordez A, and Guilhem G. Hamstring muscle elasticity differs in specialized high-performance athletes. Scand J Med Sci Sports 30: 83-91, 2020.

Avrillon S, **Hug** F, and Guilhem G. Bilateral differences in hamstring coordination in previously injured elite athletes. J Appl Physiol (1985) 128: 688-697, 2020.

Andrade RJ, Freitas SR, **Hug** F, Le Sant G, Lacourpaille L, Gross R, Quillard JB, McNair PJ, and Nordez A. Chronic effects of muscle and nerve-directed stretching on tissue mechanics. J Appl Physiol (1985) 129: 1011-1023, 2020.

Xu J, Fu SN, Zhou D, Huang C, and **Hug** F. Relationship between pre-exercise muscle stiffness and muscle damage induced by eccentric exercise. Eur J Sport Sci 19: 508-516, 2019.

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