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Editorial

Biological Mechanisms Underlying Physical Fitness and Sports Performance: An Editorial

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In general, the concept of a mechanism in biology has three distinct meanings. It may refer to a philosophical thesis about the nature of life and biology, to the internal workings of a machine-like structure, or to the causal explanation of a particular phenomenon [1].

Understanding the biological mechanisms that justify acute and chronic physiological responses to exercise interventions determines the development of training principles and training methods. A strong understanding of the effects of exercise in humans may help researchers to identify what causes specific biological changes and to properly identify the most adequate processes for implementing a training stimulus [1].

Despite the significant body of knowledge regarding the physiological and physical effects of different training methods (based on load dimensions), some biological causes of those changes are still unknown. Additionally, few studies have focused on natural biological variability in humans and how specific human properties may underlie different responses to the same training intervention. Thus, more original research is needed to provide plausible biological mechanisms that may explain the physiological and physical effects of exercise and training in humans.

In this Special Issue, we discuss/demonstrate the biological mechanisms that underlie the beneficial effects of physical fitness and sports performance, as well as their importance and their role in/influences on physical health.

A total of 28 manuscripts are published here, of which 25 are original articles, two are reviews, and one is a systematic review.

Two papers are on neuromuscular training programs (NMTs), training monotony (TM), and training strain (TS) in soccer players [2,3]; five articles provide innovative findings about testosterone and cortisol [4,5], gastrointestinal hormones [6], spirulina [7], and concentrations of erythroferrone (ERFE) [8]; another five papers analyze fitness and its association with other variables [7,9–12]; three papers examine body composition in elite female soccer players [2], adolescents [6], and obese women [7]; five articles examines the effects of high-intensity interval training (HIIT) [7,10,13–15]; one paper examines the acute effects of different levels of hypoxia on maximal strength, muscular endurance, and cognitive function [16]; another article evaluates the efficiency of using vibrating exercise equipment (VEE) compared with using sham-VEE in women with CLBP (chronic low-back pain) [17]; one article compares the effects of different exercise modes on autonomic modulation in patients with T2D (type 2 diabetes mellitus) [14]; and another paper analyzes the changes in ABB (acid–base balance) in the capillaries of kickboxers [18]. Other studies evaluate: the effects of resistance training on oxidative stress and muscle damage in spinal

Citation: Badicu, G.; Clemente, F.M.; Murawska-Cialowicz, E. Biological Mechanisms Underlying Physical Fitness and Sports Performance: An Editorial. *Biology* **2022**, *11*, 1425. https://doi.org/10.3390/biology11101425

Received: 27 September 2022
Accepted: 28 September 2022
Published: 29 September 2022

cord-injured rats [19]; the effects of muscle training on core muscle performance in rhythmic gymnasts [20]; the physiological profiles of road cyclist in different age categories [21]; changes in body composition during the COVID-19 [22]; a mathematical model capable of predicting 2000 m rowing performance using a maximum-effort 100 m indoor rowing ergometer [23]; the effects of ibuprofen on performance and oxidative stress [24]; the associations of vitamin D levels with various motor performance tests [12]; the level of knowledge on FM (Fibromyalgia) [25]; and the ability of a specific BIVA (bioelectrical impedance vector analysis) to identify changes in fat mass after a 16-week lifestyle program in former athletes [26]. Finally, one review evaluates evidence from published systematic reviews and meta-analyses about the efficacy of exercise on depressive symptoms in cancer patients [27]; another review presents the current state of knowledge on satellite cell-dependent skeletal muscle regeneration [28]; and a systematic review evaluates the effects of exercise on depressive symptoms among women during the postpartum period [29].

Author Contributions: Conceptualization, G.B., F.M.C. and E.M.-C.; writing—original draft preparation, G.B.; writing—review and editing, F.M.C. and E.M.-C. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Nicholson, D.J. The concept of mechanism in biology. *Stud. Hist. Philos. Sci. Part C Stud. Hist. Philos. Biol. Biomed. Sci.* **2012**, *43*, 152–163. [CrossRef] [PubMed]
2. Roso-Moliner, A.; Mainer-Pardos, E.; Arjol-Serrano, J.L.; Cartón-Llorente, A.; Nobari, H.; Lozano, D. Evaluation of 10-Week Neuromuscular Training Program on Body Composition of Elite Female Soccer Players. *Biology* **2022**, *11*, 1062. [CrossRef] [PubMed]
3. Nobari, H.; Gholizadeh, R.; Martins, A.D.; Badicu, G.; Oliveira, R. In-Season Quantification and Relationship of External and Internal Intensity, Sleep Quality, and Psychological or Physical Stressors of Semi-Professional Soccer Players. *Biology* **2022**, *11*, 467. [CrossRef] [PubMed]
4. Zurek, G.; Danek, N.; Żurek, A.; Nowak-Kornicka, J.; Żelaźniewicz, A.; Orzechowski, S.; Stefaniak, T.; Nawrat, M.; Kowal, M. Effects of Dominance and Sprint Interval Exercise on Testosterone and Cortisol Levels in Strength-, Endurance-, and Non-Training Men. *Biology* **2022**, *11*, 961. [CrossRef]
5. Burgos, J.; Viribay, A.; Calleja-González, J.; Fernández-Lázaro, D.; Olasagasti-Ibargoien, J.; Seco-Calvo, J.; Mielgo-Ayuso, J. Long-Term Combined Effects of Citrulline and Nitrate-Rich Beetroot Extract Supplementation on Recovery Status in Trained Male Triathletes: A Randomized, Double-Blind, Placebo-Controlled Trial. *Biology* **2022**, *11*, 75. [CrossRef] [PubMed]
6. Vasto, S.; Amato, A.; Proia, P.; Baldassano, S. Is the Secret in the Gut? SuperJump Activity Improves Bone Remodeling and Glucose Homeostasis by GLP-1 and GIP Peptides in Eumenorrheic Women. *Biology* **2022**, *11*, 296. [CrossRef]
7. Nobari, H.; Gandomani, E.E.; Reisi, J.; Vahabidelshad, R.; Suzuki, K.; Volpe, S.L.; Pérez-Gómez, J. Effects of 8 Weeks of High-Intensity Interval Training and Spirulina Supplementation on Immunoglobin Levels, Cardio-Respiratory Fitness, and Body Composition of Overweight and Obese Women. *Biology* **2022**, *11*, 196. [CrossRef]
8. Dziembowska, I.; Wójcik, M.; Bukowski, J.; Żekanowska, E. Physical Training Increases Erythroferrone Levels in Men. *Biology* **2021**, *10*, 1215. [CrossRef]
9. Jastrzębska, A.D.; Hebisz, R.; Hebisz, P. Temporal Skin Temperature as an Indicator of Cardiorespiratory Fitness Assessed with Selected Methods. *Biology* **2022**, *11*, 948. [CrossRef]
10. Domaradzki, J.; Koźlenia, D.; Popowczak, M. Prevalence of Positive Effects on Body Fat Percentage, Cardiovascular Parameters, and Cardiorespiratory Fitness after 10-Week High-Intensity Interval Training in Adolescents. *Biology* **2022**, *11*, 424. [CrossRef]
11. González-Fernández, F.T.; González-Víllora, S.; Baena-Morales, S.; Pastor-Vicedo, J.C.; Clemente, F.M.; Badicu, G.; Murawska-Ciałowicz, E. Effect of Physical Exercise Program Based on Active Breaks on Physical Fitness and Vigilance Performance. *Biology* **2021**, *10*, 1151. [CrossRef] [PubMed]
12. Gilic, B.; Kosor, J.; Jimenez-Pavon, D.; Markic, J.; Karin, Z.; Domic, D.S.; Sekulic, D. Associations of Vitamin D Levels with Physical Fitness and Motor Performance; A Cross-Sectional Study in Youth Soccer Players from Southern Croatia. *Biology* **2021**, *10*, 751. [CrossRef] [PubMed]

13. Amara, S.; Barbosa, T.M.; Chortane, O.G.; Hammami, R.; Attia, A.; Chortane, S.G.; Tillaar, R.V.D. Effect of Concurrent Resistance Training on Lower Body Strength, Leg Kick Swimming, and Sport-Specific Performance in Competitive Swimmers. *Biology* **2022**, *11*, 299. [CrossRef] [PubMed]
14. Silva, L.R.B.; Gentil, P.; Seguro, C.S.; de Oliveira, J.C.M.; Silva, M.S.; Marques, V.A.; Beltrame, T.; Rebelo, A.C.S. High-Intensity Interval Training Improves Cardiac Autonomic Function in Patients with Type 2 Diabetes: A Randomized Controlled Trial. *Biology* **2022**, *11*, 66. [CrossRef] [PubMed]
15. Arslan, E.; Kilit, B.; Clemente, F.M.; Soylu, Y.; Sögüt, M.; Badicu, G.; Akca, F.; Gokkaya, M.; Murawska-Ciałowicz, E. The Effects of Exercise Order on the Psychophysiological Responses, Physical and Technical Performances of Young Soccer Players: Combined Small-Sided Games and High-Intensity Interval Training. *Biology* **2021**, *10*, 1180. [CrossRef]
16. Karayigit, R.; Eser, M.C.; Sahin, F.N.; Sari, C.; Sanchez-Gomez, A.; Dominguez, R.; Koz, M. The Acute Effects of Normobaric Hypoxia on Strength, Muscular Endurance and Cognitive Function: Influence of Dose and Sex. *Biology* **2022**, *11*, 309. [CrossRef]
17. Zurek, G.; Kasper-Jędrzejewska, M.; Dobrowolska, I.; Mroczek, A.; Delaunay, G.; Ptaszkowski, K.; Halski, T. Vibrating Exercise Equipment in Middle-Age and Older Women with Chronic Low Back Pain and Effects on Bioelectrical Activity, Range of Motion and Pain Intensity: A Randomized, Single-Blinded Sham Intervention Study. *Biology* **2022**, *11*, 268. [CrossRef]
18. Rydzik, Ł.; Mardyła, M.; Obmiński, Z.; Więcek, M.; Maciejczyk, M.; Czarny, W.; Jaszczur-Nowicki, J.; Ambroży, T. Acid–Base Balance, Blood Gases Saturation, and Technical Tactical Skills in Kickboxing Bouts According to K1 Rules. *Biology* **2022**, *11*, 65. [CrossRef]
19. Barros, N.D.A.; Aidar, F.J.; Marçal, A.C.; Santos, J.L.; de Souza, R.F.; Menezes, J.L.; Gomes, M.Z.; de Matos, D.G.; Neves, E.B.; Carneiro, A.L.G.; et al. Effects of Resistance Training on Oxidative Stress Markers and Muscle Damage in Spinal Cord Injured Rats. *Biology* **2022**, *11*, 32. [CrossRef]
20. Esteban-García, P.; Jiménez-Díaz, J.F.; Abián-Vicén, J.; Bravo-Sánchez, A.; Rubio-Arias, J.Á. Effect of 12 Weeks Core Training on Core Muscle Performance in Rhythmic Gymnastics. *Biology* **2021**, *10*, 1210. [CrossRef]
21. Marín-Pagán, C.; Dufour, S.; Freitas, T.T.; Alcaraz, P.E. Performance Profile among Age Categories in Young Cyclists. *Biology* **2021**, *10*, 1196. [CrossRef] [PubMed]
22. Campa, F.; Bongiovanni, T.; Trecroci, A.; Rossi, A.; Greco, G.; Pasta, G.; Coratella, G. Effects of the COVID-19 Lockdown on Body Composition and Bioelectrical Phase Angle in Serie A Soccer Players: A Comparison of Two Consecutive Seasons. *Biology* **2021**, *10*, 1175. [CrossRef] [PubMed]
23. da Silva, L.F.; de Almeida-Neto, P.F.; de Matos, D.G.; Riechman, S.E.; de Queiros, V.; de Jesus, J.B.; Reis, V.M.; Clemente, F.M.; Miarka, B.; Aidar, F.J.; et al. Performance Prediction Equation for 2000 m Youth Indoor Rowing Using a 100 m Maximal Test. *Biology* **2021**, *10*, 1082. [CrossRef] [PubMed]
24. Aidar, F.J.; Fraga, G.S.; Getirana-Mota, M.; Marçal, A.C.; Santos, J.L.; de Souza, R.F.; Ferreira, A.R.P.; Neves, E.B.; Zanona, A.D.F.; Bulhões-Correia, A.; et al. Effects of Ibuprofen Use on Lymphocyte Count and Oxidative Stress in Elite Paralympic Powerlifting. *Biology* **2021**, *10*, 986. [CrossRef]
25. Mendoza-Muñoz, M.; Morenas-Martín, J.; Rodal, M.; García-Matador, J.; García-Gordillo, M.Á.; Calzada-Rodríguez, J.I. Knowledge about Fibromyalgia in Fibromyalgia Patients and Its Relation to HRQoL and Physical Activity. *Biology* **2021**, *10*, 673. [CrossRef]
26. Campa, F.; Matias, C.N.; Nunes, C.L.; Monteiro, C.P.; Francisco, R.; Jesus, F.; Marini, E.; Sardinha, L.B.; Martins, P.; Minderico, C.; et al. Specific Bioelectrical Impedance Vector Analysis Identifies Body Fat Reduction after a Lifestyle Intervention in Former Elite Athletes. *Biology* **2021**, *10*, 524. [CrossRef]
27. Marconcin, P.; Marques, A.; Ferrari, G.; Gouveia, É.R.; Peralta, M.; Ihle, A. Impact of Exercise Training on Depressive Symptoms in Cancer Patients: A Critical Analysis. *Biology* **2022**, *11*, 614. [CrossRef]
28. Kaczmarek, A.; Kaczmarek, M.; Ciałowicz, M.; Clemente, F.M.; Wolański, P.; Badicu, G.; Murawska-Ciałowicz, E. The Role of Satellite Cells in Skeletal Muscle Regeneration—The Effect of Exercise and Age. *Biology* **2021**, *10*, 1056. [CrossRef]
29. Marconcin, P.; Peralta, M.; Gouveia, É.R.; Ferrari, G.; Carraça, E.; Ihle, A.; Marques, A. Effects of Exercise during Pregnancy on Postpartum Depression: A Systematic Review of Meta-Analyses. *Biology* **2021**, *10*, 1331. [CrossRef]