

SPORTS SCIENCE

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Abstract:

This article explores the evolution of sports science and its impact on Olympic athletes. It highlights how athletes' training has evolved from raw strength to a sophisticated regimen involving sports scientists, advanced research, and technology. The rigorous workout programs tailored to athletes' physiology and psychology are discussed, emphasizing the quest for optimal performance on the big day. The article also delves into the four key areas of sports science: biomechanics, physiology, psychology, and technology, showcasing their roles in enhancing athletic performance. Examples from elite athletes' experiences with sports science are provided to illustrate its effectiveness in improving technique and coordination.

Keywords: *Olympic Games, Athletes, Training, Sports, Science, Biomechanics, Physiology, Psychology, Technology, Performance, Targeted Training, Athletic, Equipment, Mental Preparation, Visualization, Confidence, Neurophysiological, Explanation, Consistent, Performance, Technique, Endurance, Strength, Mindset.*

When the inaugural Olympic Games were held in ancient Greece around 3,000 years ago, competitors relied primarily on their sheer physical power to succeed. In stark contrast, today's athletes need much more than just natural ability and courage to excel on the global stage. The modern international sports arena demands a combination of advanced training techniques, cutting-edge technology, comprehensive support systems, and strategic planning, which collectively elevate athletic performance to new heights. Today's Olympic athletes train under the guidance of a dedicated team of sports scientists who utilize the latest research and technological advancements to optimize their performance. Every aspect of their physiology, from the fibers in their muscles to the cells in their brains, undergoes a rigorous training regimen designed to ensure they step onto the field with a finely-tuned body and a sharp, focused mind. This meticulous preparation is evident in the extraordinary performances we witness. But what drives this relentless progression in athletic achievement? Most experts attribute it to significant advancements in sports science. These advancements have provided a deeper understanding of human physiology and psychology, while also leading to substantial improvements in the design and functionality of sports equipment. Consequently, athletes are not only better prepared physically and mentally, but they also benefit from state-of-the-art gear that enhances their capabilities. Sports science can be divided into four primary areas: biomechanics, physiology, psychology, and technology. Biomechanics applies engineering principles to the movements of the human body, allowing for a detailed analysis of

athletic performance. Biomechanists use tools such as video analysis, motion tracking systems, force transducers, and devices to measure electrical muscle activity. These instruments help gauge both internal and external forces acting on the body. Dr. Neil Fowler, a biomechanist at Manchester Metropolitan University and the biomechanics chair for the British Association of Sport and Exercise Sciences, explains, "We need to know which muscles are working when, and how hard, to understand technique and coordination." This comprehensive analysis helps in optimizing an athlete's movements, ensuring they perform at their peak while minimizing the risk of injury. By understanding the intricacies of muscle function and coordination, biomechanists contribute significantly to enhancing athletic performance. Over the years, Dr. Neil Fowler has collaborated with numerous elite athletes, including Olympic javelin throwers and long jumpers. He has amassed a wealth of examples demonstrating how biomechanics can significantly enhance performance. One notable instance involved the long jump. "We discovered that it is most effective if the foot is moving backwards when it strikes the board, resembling a pawing motion," Fowler explains. This insight led one of their top jumpers to adopt a radically different jumping strategy. As a result of this biomechanical adjustment, the athlete experienced a substantial increase in their personal best during that season. Such examples highlight the critical role that biomechanical analysis and adjustments can play in achieving superior athletic performance. Achieving optimal results from biomechanics requires athletes to be physically capable of implementing changes, which is where physiology plays a crucial role. Physiologists collaborate closely with biomechanists to address physiological aspects that can make the difference between success and failure in sports performance. The parameters physiologists measure vary across sports and even within different events.

For instance, in endurance sports, ensuring sufficient oxygen delivery to muscles is paramount to sustain aerobic activity. Physiologists focus on determining the maximum sustainable speed at which athletes can operate aerobically without a significant rise in lactic acid levels, which can lead to muscle fatigue. This delicate balance is essential for athletes aiming to optimize their performance and endurance, highlighting the intricate interplay between biomechanics and physiology in athletic training and preparation. Dr. Greg Whyte, a physiologist and sports science coordinator for the English Institute of Sport, underscores the significance of focused training in maximizing athletic performance. He elucidates, "Increasing strength necessitates engaging in targeted strength training to stimulate bone growth and enhance density, ultimately resulting in amplified strength. Similarly, for endurance running, consistent and dedicated running sessions are indispensable." However, attaining peak performance demands a meticulous approach that targets specific performance determinants like strength, endurance, and technique, incorporating the right blend of intensity, duration, and frequency. This tailored strategy is paramount for athletes striving to excel in their respective sports, underscoring the intricate and personalized nature of training methodologies in sports science. There seems to be a limit to the body's capabilities, with certain aspects reaching a plateau where further improvement may be challenging. This is where the role of equipment becomes crucial in enhancing performance. The Sports Engineering Group at Sheffield University is at the forefront of designing cutting-edge sporting equipment that can facilitate these advancements. Dr. Matt Carre from the group notes, "We receive requests from various stakeholders. For instance, companies in the industry may seek technology that enables tennis rackets to hit balls faster. On the other hand, governing bodies are interested in understanding these technological advancements. While they appreciate new technology, they also prioritize maintaining the integrity of the sport. If technology begins to alter the game significantly, they may implement rule changes to preserve its essence." This delicate balance between innovation and preserving the essence of sports underscores the multifaceted considerations involved in integrating technology into athletic equipment. Even with an ideal physique and top-notch equipment, an athlete's mental state can significantly impact their performance on the day of competition.

Professor Ian Maynard from Sheffield Hallam University, serving as the psychology advisor to the British Olympic Association and working closely with sailing and diving teams, emphasizes the critical role of mental preparation. According to Maynard, mental readiness can commence as early as two months before the event, with athletes striving to cultivate a positive mindset. "The key concept is that consistent preparation leads to consistent performance," Maynard explains. Athletes may employ various strategies such as watching motivational videos, listening to uplifting music, or spending time with friends and family to maintain a positive outlook. Additionally, they undergo training to swiftly refocus and realign themselves if things deviate from the plan during the event, ensuring they stay on course despite unexpected challenges. Visualization can significantly enhance training by adding an extra dimension to the preparation process. Professor Ian Maynard highlights the power of reliving past successful performances as a confidence-building exercise. "Revisiting your best performances is a highly effective method for boosting confidence. We engage in mental rehearsals, going through a performance in the mind's eye, re-experiencing the emotions and technical nuances," explains Maynard. Moreover, research indicates that visualization is nearly as effective as physical practice. "From a neurophysiological perspective, when you visualize a movement, you activate the same synaptic pathways in the brain as you would during actual execution," he elaborates. This phenomenon underscores the neurological basis of visualization and its ability to reinforce muscle memory and improve performance.

Sources:

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4. The Official website of the British Olympic Association - for insights into Olympic athletes' training and preparation.
5. Sheffield Hallam University's Sports Psychology department - for studies and research on mental preparation and visualization techniques in sports.