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Basketball Training Based on Animal Bionics

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Abstract: Bionics as an independent discipline, in recent years, bionics has developed rapidly and has been applied to the fields of medicine, military, aviation, industry, sports, involving nanotechnology, biotechnology, and information. Research in many frontier disciplines such as technology and cognitive technology. In traditional sports, bionics is a bridge between biological systems and fitness exercises. It enables people to actively learn biological science knowledge and consciously seek new health care ideas and principles from biological systems. It is a kind of human conscious learning from the biological world. Specific performance. The task of bionics in traditional sports health is to study the superior ability, effective ability and principle of biological system, and simulate it through limb movement, and then apply these principles to design and compile innovative training modes; traditional sports health The bionic mission of bionics provides humans with the most reliable, flexible, efficient, and economical training methods close to biological systems. This paper mainly uses literature data method, logic analysis method and expert interview method to study the application of bionics in basketball, scientifically reveal its internal relationship with biological science, and give bionics scientific, contemporary and innovative. The following conclusions: Animal bionics plays a major role in the basketball education profession. It has comprehensive professional skills, advanced teaching techniques and concepts, scientific innovation spirit and social practice ability. It can engage in basic sports teaching, organization training, and arrange competitions. It can also guide the work of sports research and social sports guidance in schools. It can accelerate the health treatment and training of injured players through bionics research. It can be said that it greatly promotes the development of today's social sports.

1. Introduction

The development of science and technology to the present day, the technological devices created by human beings are increasingly complex and expensive, bulky and unreliable, unable to meet the increasing demands of industry, agriculture, medicine and military technology, forcing people to find new technical principles. In the evolution of billions of years, through the strict natural selection and the survival and development in the competition of the biological world, they have

developed a unique ability to form many effective navigation, recognition, calculation, Systems such as biosynthesis and energy conversion are surprisingly small, sensitive, rapid, efficient, reliable and anti-interference, and are beyond the reach of physics and chemistry [1]. For example, in terms of intelligence, Hehe's electronic computer is not as good as the brain of the insect area. At the moment of 0.05 seconds, mantis can calculate the direction, speed and distance of the small insects flying in front of the eyes. In one fell swoop, the electronic tracking system of the upper tons is dwarfed [2]. In various living environments, the types, structures, and functions of living things are different, so many things can be imitated. At the same time, modern engineering technology is developing rapidly, with different requirements, and there are many problems that need to be solved by imitation. Therefore, the scope of bionics research is very broad. Currently, bionics research focuses on the simulation of sensory organs, the simulation of brains, nerve cells and neural networks, the simulation of animal positioning and navigation skills, the simulation of biomechanics, the simulation of bioelectrical control, and biochemistry (mainly enzymes). Several aspects of the simulation [3].

Tong J found that the geometry of some animal organs has significant functions and characteristics that provide useful information for bionic engineering applications [4]. Therefore, it is necessary to quantitatively measure the geometry of those animal organs. However, some animal organs are tiny, complex and at the mesoscale (0.1 is similar to 10 mm). Their potential biomimetic applications require an accurate and efficient way to quantify their geometry. However, existing methods are difficult to quantify. However, it has been found that outer edge geometry information can be obtained from stereomicrographs using MATLAB image processing and computer vision techniques [5]. In this work, based on MATLAB, a program was designed and a method was proposed for extracting the outer contour points of mesoscale animal organs [6]. The process of obtaining quantitative geometric information can lead to the following conclusions: stereomicroscopy images of animal organs of imitation organisms are prepared, images with reduced noise interference are processed, outer contour points are detected, and point x and y coordinate data are input to a computer database. It was stored. The front leg of the fecal beetle has a special tooth structure for burrowing. The height of the end tooth is only about 1 mm and the width is about 0.5 mm. The method is supported by this method. The outer contour is a stereo microscope image from 669 × 727 pixels. The fore limb end teeth were extracted, about 1500 outer contour points were obtained, and the point x and y coordinate data were input into a computer database for further analysis [7]. The method is efficient, accurate and easy to adapt to the quantitative analysis of geometric characteristics of other animal organs in the mesoscale. Su C has been widely used by using friction to transmit power to prevent slipping. Many animals have strong adhesion climbing ability. It is of great theoretical significance and broad use to study and prepare bionic surfaces to improve transmission friction by using biomimetic technology. Application prospects [8].

In recent years, studies on the structure of climbing animal foots show that their surface morphology has macroscopic and microscopic scale characteristics. Only the study from macroscopic to microscopic surface structure can better explain the mechanism of climbing animals to increase friction. In this paper, we will study the mesoscale surface structure from micron to millimeter. The biomimetic technique is used to study the effect of the reptile's foot structure on the frictional properties at mesoscopic scale. The bionic technique is used to prepare the convex or concave bionic non-smooth. Surface fabrication technology, the friction model of non-smooth surface is established, the friction mechanism of the bionic surface topography on the mesoscopic scale is studied, and the influence of surface topography, layout, size and material properties on the

friction characteristics is revealed, and the design bionic friction surface is provided. The calculation method of friction coefficient provides a reliable theoretical basis for engineering applications [9]. The Thompson B study found that the emergence of abstract implantable biomaterials has revolutionized medical treatment, allowing for the development of tissue engineering and medical biomimetic devices (eg, cochlear implant restoration of hearing, vagus nerve stimulator control of Parkinson's disease and cardiac pacemaker) [10]. Similarly, future material developments may continue to drive the development of disease and disability treatment, and even enhance human potential. The material requirements for implantable devices are very strict. In all cases, they must be non-toxic and provide adequate mechanical integrity for the application at hand. In the case of a scaffold for tissue regeneration, biodegradability in an appropriate time range may be required, and for medical bionics, electron conductivity is necessary. The advent of graphene and graphene composites has made materials and structures highly relevant to the expansion of biomaterial stocks of implantable medical devices. The rich chemical composition ensures that uncovered properties in the nanostructures are transferred to the world of macroscopic devices [11]. Here, the intrinsic properties of graphene and how graphene or graphene-containing structures interact with living cells and the effects of electrical stimulation on nerves and cells are reviewed.

The use of bionics in basketball reveals the intrinsic connection between it and the biological science through science, and gives the science, time and innovation of bionics. The conclusion is drawn that animal bionics play a major role in the basketball education profession. It has comprehensive technology, advanced teaching technology and philosophy, scientific innovation spirit and social practice ability. It can engage in basic sports teaching, organization training, and arrange competitions. It can also guide the work of sports research and social sports guidance in schools. It can accelerate the health treatment and training of injured players through bionics research. It can be said that it greatly promotes the development of today's social sports.

2. The Concept and Application of Bionics

2.1. The Concept of Bionics

Bionics is the science of developing machinery or various new technologies by analyzing the structure and function of organisms, simulating the principles of biological systems to construct technical systems, or making artificial technology systems have or resemble the functions of biological systems. This concept was proposed by American scientist Stephen in 1960 and formed an independent discipline. In 1963, China first cited the concept of bionics. Sports bionics is one of the disciplines of sports science and a branch of bionics. It is to study how to imitate, simulate or inspire from the structure and function of biological systems, and effectively apply it to sports technology, sports training, sports equipment and so on. The application of bionics in the field of bionics has far exceeded the scope of its initial establishment, and the sports field is no exception. High-tech bionic sports clothing, bionics training methods for sports training, etc., are all aimed at further improving sports performance. Provide theoretical and methodological guidance. The application of bionics in sportswear bionics provides a theoretical basis for the manufacture of sports training or competition clothing. According to this theory, various sports costumes simulating life systems are designed. People study a variety of sportswear by studying the body structure, morphological characteristics, and functional patterns of other living things in the biological world. The emergence of intelligent sportswear provides a guarantee for scientific sports training. He uses the "pong ball principle" of the plant kingdom. The seeds of pine trees are in the mature season, the

pine balls will automatically open the scales above, and the seeds will be Natural shedding. According to this principle, researchers use wool and other new materials with better thermal insulation and water absorption properties to create various pine-like protrusions on the fabric. The radius is about 2.5 microns. The body temperature rises during the exercise. After sweating, the loose ball bump on the surface of the garment will naturally open, forming a miniature air circulation system, the sweat will evaporate, and the outside cold air can enter, thus cooling down. When there is no sweat, the loose ball will automatically close to maintain the insulation effect.

2.2. Application of Bionics in Sports Protection Equipment

Bionic protective equipment is also manufactured according to the various protective skills of the animal kingdom. There are many animals in the animal kingdom that rely on a strong outer skin or carapace to defend against attacks by similar or other animals. According to this principle, people have created a variety of sports room protective clothing to prevent impact, especially in some highly sporting sports, such as: football, baseball, hockey, helmets in racing cars, these clothing not only requires Good strength, prevent breakage, and also need good cushioning capacity and breathability. The application of bionics in sports and training methods back in the Western Han Dynasty more than 2,000 years ago, ancient Chinese people exercised by observing animals and imitating various movements of animals. This phenomenon was confirmed on the "Guide Map" of the painting on the tomb of the Western Han Dynasty at No. 3 Mawangdui, Changsha. The famous "Five Birds Play" is a gesture and action that imitates the five kinds of animals such as tigers, deer, bears, donkeys and cranes. Many martial arts routines in China, monkey fists and taekwondo are also some of the actions of imitating animals, and they are scientifically summarized and The track and field sports sprint project now uses the squat start, its inventor is a long-term observation of the kangaroo jump action imitation, the kangaroo in the exercise is first to lower the center of gravity, lower limbs overlap, the body is compressed into a spring, and then suddenly According to this principle, the body has developed a relatively mature squat start technique, which greatly improves the performance of the sprint. The modern sports biologist uses high speed. The camera took pictures of the horse's movements and analyzed the data of the movements. The study found that the mystery of the horse running fast is that the hind legs are powerful. This discovery has changed people's training ideas, so modern sprinters in order to improve their performance,蹬 training is the most important thing. Breaststroke is the principle of imitating the water after frog's lower limbs. Bionics as a new learning It is widely used in real life, and its integration with modern high technology is getting faster and faster. The development of modern competitive sports is a contest between the scientific and technological strengths of various countries. There is still a lot of space for the practice and theoretical research of bionics in sports. This undoubtedly provides a good opportunity for the development of bionics in the field of sports. In addition to further research in sportswear, protective gear, training methods, etc. The application of bionics in other disciplines proves that microscopic or Molecular level bionics will be the direction of bionics development in the field of sports. Dai Zhendong, a professor at the Institute of Biomimetic Structures and Materials Protection of Nanjing University of Aeronautics and Astronautics, can control the movement of the gecko by inputting electrical signals into the gecko brain. In the field of information bionics, similar work is being carried out abroad. The United States has exercise control of rats and sharks. Many units in the country are also exploring this aspect. This study will treat patients with sports injuries that are seriously disabled. Bring hope.

3. Research Object and Method

3.1. Research Object

Bionics is a science and technology that mimics the special skills of living things, using the structure and functional principles of living organisms to develop machinery or various new technologies. Humans imitate creatures, learn from the biological world, and try in sports, which was already in ancient times. So far, a wide variety of biospheres have formed an extremely precise and perfect ability to adapt to internal and external environmental changes during the long process of evolution and natural selection. When human beings exercise and use physical equipment, equipment and other physical fitness to improve the level of competitive sports, it is natural to learn and learn from the various "super powers" of the biological world. Some miraculous abilities and structures in the plant and animal worlds are not available to humans, so humans began to study and simulate the excellent morphological structure and function of living things, and learn from the biological world. In the heavy-duty training and high-intensity competitions of modern basketball, physical fitness plays an indispensable role in the whole movement. In other words, the modern basketball game, which lacks physical reserves and training, cannot be greatly developed. The intelligence, skills, tactical ability and mental ability of basketball athletic ability must be combined with physical training to have a good development.

The intensity of modern basketball is high. Only a good physical reserve can carry out high-intensity and large-volume training, in order to obtain good training results, athletic ability can be improved, good athletic performance is achieved, and high-level training goals are achieved. In sports, basketball is a high-intensity, intermittent, and relatively long-lasting sport. At present, China's basketball physical training is still in its infancy, analyzing domestic and foreign players. There is a certain gap between the two in terms of offense and defense. When strengthening and analyzing physical training, we must first analyze the basketball physical training. Some of the problems, and then put forward some corresponding strategies. Strength and speed are the foundation of basketball. If there is no good strength and speed, it is difficult to take the initiative in high-intensity confrontation. Moreover, strength and speed are also the fundamental and source of technology and tactics. Because of the different positions, the training of strength and speed should also be taught in accordance with the aptitude. For example, the center players are mainly characterized by tall and strong, and the inner line is mainly based on physical confrontation. Without good strength as the basic guarantee, it is difficult to have a foothold. Not only in offense, but also in defense. Therefore, power is another important factor in addition to technology in both offense and defense. Modern basketball technology generally speeds up. The previous fast break technology was initiated and participated by the defenders. The development of modern basketball is also involved in the design of the technical and tactical center and forward.

3.2. Research Methods

Rebounding, breakthrough acceleration, and reaction speed are all examples of the athlete's explosive power. In the development of explosive exercises, it is not practiced with heavy weights. Weight exercises can be performed according to the athlete's own weight. Generally, 30% of the weight is used, and sometimes it can be practiced without weight. The number of exercises and the number of groups should be such that the excitability of the central nervous system is not reduced, and the number of exercises is generally 1 to 5 times. The practice mainly involves weighing 30% of your own weight or relying on your own weight to quickly jump or run the stairs quickly.

Practice in many aspects, and strive to achieve the best results. However, sports are not only full of physical strength, but also full of bionics in many sports techniques. Australian sprinter Cha Sherr was occasionally inspired by the wallaby while suffering from stagnant results. This kind of kangaroo looks like a big belly, but it has the ability to fly quickly. When you run, you can jump from 1.2 meters to 1.9 meters, and when you run, you can jump up to 12 meters. If necessary, its speed can reach more than 70 kilometers per hour without any difficulty, especially the speed of its sudden start is enviable. After observing, Cha Sherlier found that the kangaroo always bends down before the jump, the abdomen is almost close to the ground, and then starts at the speed of ejection. As a result, he used a kangaroo-like starting action in the tradition of standing up for many years. Although there was no stopwatch at the time, by experience, he and the coach felt much faster than before. Therefore, adding a bionic learning method to basketball can not only save the player's physical strength but also make the player's speed faster.

Many famous players' career bottlenecks or retired main causes are caused by major injuries, such as Achilles tendon rupture, knee strain, etc. Now bionics can develop artificial organs, such as the development of "atomic power heart", "artificial kidney ", artificial ear", "artificial blood vessel", "artificial blood", "artificial arm", "respirator" and so on. A broadly developed atomic power heart, can completely replace the work of the heart of the test animal; the dialysis plate and filter using artificial kidney of transparent fiber material, has the advantages of easy observation, disinfection, purification and replacement. A prosthetic arm that draws control signals from the central nervous system and has a feedback system whose artificial arm is realistic and can perform six basic actions like the real arm. Artificial respirators have also been used abroad. The current medical bionics research has successfully used the artificial hand controlled by myoelectricity. This kind of fake hand is better than the original fake hand, and the grip and control are more satisfactory. I can handle the trivial things of eating, dressing, etc., as I do, and I can drive a car and do physical labor. At present, the commonly used artificial hand is pulled by the movement of the other side arm, and this control method is completely different from the control of the real hand. The artificial hand of myoelectric control allows the disabled to control in the same way as the real hand. This is the direction of prosthetic development. Many muscles are highly coordinated, cleverly matched with contraction, so that the hand can do many complicated and complex movements. The person also corrects the movement of the opponent's various senses, so that the hand moves correctly according to the will of the person. For patients with residual limbs, there may be myoelectric power extracted from the muscles of the residual limb to control the prosthetic hand. For example, an amputee below the elbow joint can use the remaining myoelectricity of the extensor muscle to control the opening of the prosthetic hand, so that he controls the prosthetic opening and pinching to be consistent with the original habit. Human sickle anemia, phenylketonuria, urinary acidosis and milk poisoning, etc., are caused by lack of enzymes or insufficient activity. It is estimated that bionics can produce the corresponding enzymes implanted into the human body within 50 years to treat these so-called "molecular diseases" that are now helpless. Therefore, in the future, there is great hope that the key parts of the human body, such as the Achilles tendon and the ligament, can be reconstructed through bionics.

4. Discussion

4.1. Animal Bionic Research Analysis

Animal bionics is a science that studies how to imitate animal movements to exercise and improve the level of physical skill in sports. It is a branch of bionics and an interdisciplinary subject

between sports science and bionics. His main research contents include: (1) directly imitating the animal's shape movements to exercise the body; (2) seeking ways to improve people's functional ability and athletic performance by studying the animal's high athletic ability and adaptability to large exercise loads. And methods. Many of the superb skills of mankind are not available to other creatures, but the skill of hundreds of millions of creatures is precisely what human beings lack in the spirit of all things. Human beings learn from animals, learn their strengths, make up their own shortcomings, and realize many ways of health. Following the purpose of various animal health methods to achieve strength, health, longevity, etc., it is called bionic health. Borrowing the concepts, principles, and methods of other related disciplines to study people and educational phenomena in the process of education, using biological phenomena in nature to compare people, using bionic methods to analyze human educational phenomena, and clarifying the laws of education, thus deepening or update the understanding of the law of education. Unlike other bionics, education bionics not only cares about biology and nature, but cares about the development of all disciplines. Introducing the ideas, methods, and principles of bionics into the field of educational research, using the method of bionics to study the educational phenomenon of human beings, comparing human and biological, human development and biological growth, mimicking the mechanism of action of living things. To understand the educational problems of human beings, or to enlighten them from the laws governing the growth of living things, and to explore the laws of education. The research results of adjacent disciplines are used as the source of wisdom and theoretical support for educational research.

The 2004 Athens Olympics, a "shark suit" swimming competition, was famous for its design and manufacture by the British swimming equipment brand Speedo. Their company "Sharks" helped athletes from all over the Olympic Games. Got 46 medals. This new swimsuit is a model of high-tech bionics (pictured from Baidu www.baidu.com). In the process of developing the "shark suit", the researchers found that the shark's skin is not smooth, but the speed in the water is very fast. The biologists found through the structure of the shark skin that the shark's skin is rough and the surface is arranged. Numerous tiny V-shaped pleats are formed. In the manufacturing process, the design and development personnel adopted a high-tech new material that imitated the shark skin structure, and designed and manufactured the “shark skin” swimsuit. Since the swimsuit has no seams, its surface structure mimics the shark skin structure. The resistance in the water is very small, the good elasticity can be completely attached to the human body. In addition, the special strips used on the swimsuit can make the swimmer's body as streamlined as possible, and reduce the resistance when swimming.

Figure 1. Shark suit

4.2. Analysis of Basketball Sports by Bionics Single Factor Analysis

Table 1. Measurement results of male and female indicators

Sex	Man			Woman		
Indicator	Mean	Maximum	Minimum	Mean	Maximum	Minimum
Height	188.9	198	180	177.8	185	170
Lower Limb Length*100/Height	57.6	63.4	55.1	57.4	61.7	53.8
Run-up Vertical Jump Height	84	103	64	72.8	87	52

Univariate analysis is used to study the effects of multi-factors on vertical jumps. Not only is the survey workload large, the calculations are complicated, but the intricate interactions among the various factors still have no conclusions. The stepwise regression analysis method is free from the interference of interaction, which can reflect the true face of things more realistically and make predictions to provide a basis for scientific selection. To this end, we select 50 basketball players related indicators to study with stepwise regression analysis, and strive to find out the main factors affecting the vertical jump ability of the body, and further explore the relationship between vertical jump ability and morphological structure and function. The results of the survey on the absolute height of the excellent and mobilized run-up vertical jump are shown in Table 1 and Figure 2:

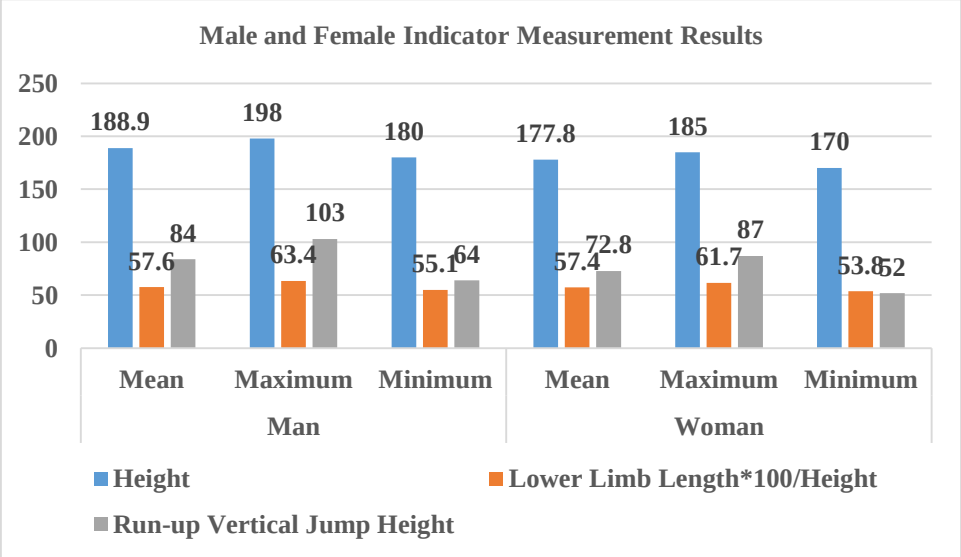

Figure 2. Measurement results of male and female indicators

The absolute height of the run-up vertical jump: the run-up vertical jump mainly relies on the muscle strength and speed of the lower limbs to generate explosive force under the action of the bone lever. Therefore, the shape and structural characteristics and ratio of the lower limb joints are closely related to the function. British scholar A Ẇ Ƀacot studied the life and habits of fleas and found that flea jumps can reach 40 times the length of the flea and 200 times the length of the jump. Compared with people, a five-foot tall person should jump 200 feet and jump 1000 feet. Foreign scholars also study: jumping insects have long and strong legs, and the strength is related to the strength of the muscles of the scorpion. Especially the levator spurs are abnormally developed. The number of muscles in jumping feet is often much higher than that of higher animals. White muscle

fiber. Jumping animals have a particularly long foot and a particularly high foot height. For example, the Australian kangaroo has a weight of about 70 kg and a long hind leg. It can reach a height of about 12 meters when jumping, and a height of 3.3 meters. The fore body at the start. Always bent, almost close to the ground. The starting position of this position was later adopted by Australian sprinters and coaches. As a result, the starting speed was significantly accelerated, and a "squat" start (Figure 3 from Baidu, *www.baidu.com*).

Figure 3. Kangaroo

It can be seen from Fig. 4 that the jumping ability of the jumping animal is unmatched by human beings. The human or animal adapts to the ever-changing external environment, and the shape changes with the change of the environment. This is the evolutionary law. For example, the giraffe's neck is long, the hind legs of the squirrels are longer than the body length, and the cockroaches or insects (everything that are good at jumping) are very long, all in order to find food, catch food or escape danger. From the perspective of human beings, there are obvious individual differences in the morphological structure and limb ratio of different people. These differences are inherited with human evolution. Therefore, although the influence of the athlete's vertical jump ability, the acquired training factor is very important, but the hereditary nature cannot be ignored. Because the morphological structure and function are unified. In short, sports bionics is getting more and more people's attention. Many of the versatile talents in the biological world, as long as the rational use of animal bionics in the field of sports will definitely bring new and higher development to sports technology training.

Figure 4. Jump indicator measurement results

5. Conclusion

(1) Using bionic thoughts and philosophical thoughts, infiltrating physical education, treating biodiversity and superiority in a dialectical manner, scientifically and rationally acquiring the superb skills and unique biological characteristics and character. Such as faithful and conscientious shepherd dogs, united and cooperative bees, lofty geese, down-to-earth elephants, bears of heavy bears, bravely challenged lions, witty monkeys, etc., their good character and characteristics can be used for humans. use.

(2) The various creatures in nature have the same development process as human beings. In this process, they also encountered many "scientific problems". They also tried their best to solve problems for their own survival and development. The same creatures must also go through the process of evolution from low to high, and also follow the natural law of "survival of the fittest". This is extraordinary in today's human evolution, physical and physical degradation.

(3) Sports come from life, serve human beings, human beings are born in nature, people and society originate and develop in nature, and physical education is produced and developed along with the origin and development of people and society. In this sense, physical education should return its natural attributes both in the past and in the future. This is also the pursuit of modern people for their natural nature. What we need to do now is to discover, imitate and learn from the other disciplines in the natural world, to find and imitate those optimized and reasonable practices, to solve our physical education teaching problems, and to make our physical education teaching closer to nature. Close to life, more in line with the needs of human health and harmonious development.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

References

[1] Frisoli, A., Salsedo, F., Bergamasco, M., Rossi, B., & Carboncini, M. C. (2014) "A Force-feedback Exoskeleton for Upper-limb Rehabilitation in Virtual Reality", Applied Bionics & Biomechanics, 6(2), pp. 115-126. https://doi.org/10.1155/2009/378254

[2] Beyl, P., Damme, M. V., Ham, R. V., Vanderborght, B., & Lefeber, D. (2014) "Design and Control of a Lower Limb Exoskeleton for Robot-assisted Gait Training", Applied Bionics & Biomechanics, 6(2), pp. 229-243. https://doi.org/10.1155/2009/580734

[3] Ayers, J., Rulkov, N., Dan, K., Kim, Y. B., Volkovskii, A., & Selverston, A. (2015) "Controlling Underwater Robots with Electronic Nervous Systems", Applied Bionics & Biomechanics, 7(1), pp. 57-67. https://doi.org/10.1155/2010/578604

[4] Gottlieb, J. R., Tangorra, J. L., Esposito, C. J., & Lauder, G. V. (2014) "A Biologically Derived Pectoral Fin for Yaw Turn Manoeuvres", Applied Bionics & Biomechanics, 7(1), pp. 41-55. https://doi.org/10.1155/2010/635280

[5] Giraldo, J. P., Landry, M. P., Faltermeier, S. M., Mcnicholas, T. P., Iverson, N. M., & Boghossian, A. A.(2014) "Plant Nanobionics Approach to Augment Photosynthesis and Biochemical Sensing", Nature Materials,13(4), pp. 400. https://doi.org/10.1038/nmat3890

[6] Tsuda, S., Jones, J., & Adamatzky, A. (2014) "Towards Physarum Engines", Applied Bionics & Biomechanics, 9(3), pp. 221-240. https://doi.org/10.1155/2012/613505

[7] Liu, G., Wang, A., Wang, X., & Liu, P. (2016) "A Review of Artificial Lateral Line in Sensor Fabrication and Bionic Applications for Robot Fish", Applied Bionics and Biomechanics, 2016(5), pp. 1-15. https://doi.org/10.1155/2016/4732703

[8] Tong, J. , Zhang, Z. H. , Chen, D. H. , Wang, H. C. , & Ma, Y. H. (2014) "A Method for Quantitative Analysis of Geometrical Structure of Animal Organs in Meso-scale: the Dung Beetle Foreleg End Tooth as A Case Example", Applied Mechanics and Materials, 461(3), pp. 3-16.

[9] Su, C., Ning, L., & Xiao, L. (2014) "The Research on Friction Characteristics of Non Smooth Bionic Mesoscopic Surface", International Journal Bioautomation, 18(4), pp. 325-336.

[10] Thompson, B. C., Murray, E., & Wallace, G. G. (2016) "Graphite Oxide to Graphene. Biomaterials to Bionics. Advanced Materials, 27(46), pp. 7563-7582. https://doi.org/10.1002/adma.201500411

[11] Zhili Zhang, Guohao Yu, Xiaodong Zhang, Xuguang Deng, Shuiming Li, & Yaming Fan. (2016) "Studies on High-voltage Gan-on-si Mis-hemts Using Lpcvd Si3n4 as Gate Dielectric and Passivation Layer", IEEE Transactions on Electron Devices, 63(2), pp. 1-8. https://doi.org/10.1109/TED.2015.2510445