



International Society of Bionic Engineering

NEWSLETTER

Vol.2 Issue 1 June, 2013



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Upcoming Activities

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ISBE is an educational, non-profit, non-political organization formed in 2010 to foster the exchange of information on bionic engineering research, development and application.

Our Mission:

The society is dedicated to the advancement of communication and cooperation among all scholars, and the furtherance of knowledge and education in the field of bionic engineering.

Membership

ISBE Membership

ISBE membership is open to those who have manifested a continuous interest in any discipline important to bionic engineering research as evidenced by work in the field, original contributions and attendance at meetings concerning bionic engineering research.

For more membership information, please visit <http://www.isbe-online.org>

Wilhelm Barthlott (Germany) University of Bonn

Wilhelm Barthlott is a German botanist and bionics expert. He is also one of ISBE's board members.

Barthlott's areas of specialization are systematics and biodiversity research, with the focus devoted to tropical ecosystems and the global distribution of biodiversity. He is one of the pioneers in the field of biological and technical interfaces. Based on his systematic research on scanning electron microscopy of plant surfaces, he developed self-cleaning (lotus effect) technical surfaces and, in recent years, surfaces which permanently retain air under water. This led to a paradigm shift in particular areas of materials science and facilitated the development of superhydrophobic biomimetic surfaces. This technology has successfully been launched on the market under the trademark Lotus-Effect®.

Barthlott has been honored with various awards and prizes, e. g. the German Environment Prize (Deutscher Umweltpreis). He is a member of the Academy of Sciences and Literature of Mainz, the North Rhine-Westphalia Academy of Sciences and Arts, the German Academy of Sciences Leopoldina, and is a Foreign Member of the Linnean Society of London.



Zhang Deyuan (China)

Beihang University

Zhang Deyuan received his B.S. degree (1984) and M.S. degree (1987) in Mechanical manufacturing and automation from Jilin University of Technology of China and received his Ph.D. degree (1993) from Beihang University of China. Then, he has been the associate professor (1994) and the professor (1997) in Beihang University of China. Zhang Deyuan's



research interest is focused on the bio/bionic-manufacturing of functional surface, micro/nano machining and ultrasonic vibration machining.

Current research progresses of Deyuan Zhang's group in bio/bionic-manufacturing mainly three aspects: A polymer replica of shark skin has been fabricated with nanoscale replication accuracy; Different highly sensitive bio-detection chips with hierarchical structures have been fabricated with porous silica frustules of diatoms. Helical light-weight conductive silver particles have been fabricated by depositing nanoscale silver coatings on the surface of spirulina cells.

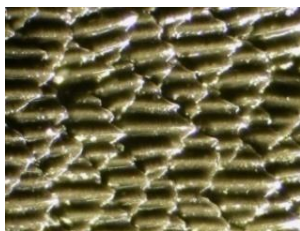


Fig. 1 Replica of shark skin

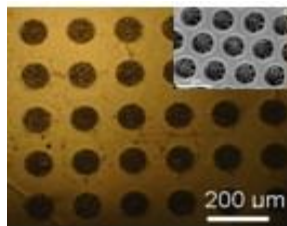


Fig.2 Bio-detection chips with hierarchical diatom frustules array.

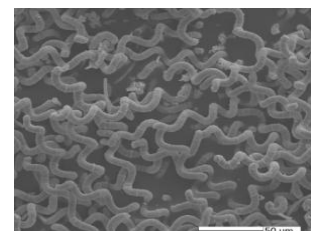


Fig. 3 Conductive silver-coated Spirulina cells

Deyuan Zhang's group has proposed series of bio-machining/bio-forming methods, such as bio-removal machining, bio-limited forming, bio-replicated forming, bio-growing forming, bio-assembly forming, bio-joining forming, bio-scaling forming, and bio-deforming machining and so on, providing new techniques of fabricating structures. The group members would like to communicate and discuss with corresponding researchers who have interests in the research mentioned above.

Mihai CHIRITA (Romania)

Medicine and Pharmacy University

Mihai CHIRITA is the professor at Faculty of Medical Bioengineering, Medicine and Pharmacy University, Romania.

Mihai introduced biomimetics In 3 university courses: Biomaterials, Transport phenomena in biomedical engineering and Complex structures in medicine and surgery.



Jan Czernuszka (UK)

Oxford University

Jan Czernuszka is a University Lecturer at the University of Oxford and a Fellow of Trinity College. He is a Founding Scientist of Oxtex and its Chief Technical Officer. Jan set up and is Head of the Biomaterials Group at Oxford.

Jan has been Dean and vice-President of Trinity College And is currently Chairman of the Faculty of Materials.

He has a BSc (Hons) and ARSM from Imperial College, London, a Ph.D from the University of Cambridge and an M.A from the University of Oxford.

ISBE Secretariat is always calling for news among our members. If you have information you would like to include in future editions of the newsletter, just feel free to contact us.



News and Events



The International Society of Bionic Engineering (ISBE) honors and encourages excellent members who make great progress in bionic engineering field, and to further promote the development of bionic discipline.

1) ***Bionic Engineering Outstanding Contribution Award:***

Two winners, each one will be awarded 30,000 RMB;

2) ***Bionic Engineering Outstanding Youth Award:***

Two winners aged under 40 years old, and each one will be awarded 10,000 RMB.

The Award Committee has been established in the April following the guidelines of Award Measures, and the nominations will be assessed equally on the nominee's merits and eligibility. The final result will be announced at the 4th International Conference of Bionic Engineering (ICBE2013) when the winners will be presented with the certificate and monetary award.

Award Source

Bionic Engineering Award is sponsored by the members of ISBE voluntarily to reward the members who make outstanding contributions to bionic engineering research. The award is presented at the International Conference of Bionic Engineering held every three years. The award in 2013 is 100,000 RMB donated by Prof. Luquan REN, the Member of the Chinese Academy of Sciences (CAS) and Standing Vice President of ISBE.

The 5th Bionics Symposium at the ITV Denkendorf Bio-inspired Fiber Materials

by Thomas Stegmaier, Germany

“Bionics is the technical implementation of results of biological evolution“- as Dr. Michael Herdy of Inpro GmbH Berlin mentioned during the symposium. That biology offers a storehouse of knowledge for technical findings is recognized in the world of science. Materials and construction principles can be derived from solutions that were tested in nature, which offer large innovation potential for engineering.

At the bionics symposium, held on 8 May 2013 in Denkendorf, scientists and project partners from the industry exchange views regularly on how textile technology profits from this approach on research and which products and processes are in the current bionical pipeline.

The symposium was opened by Dr. Götz Gresser, CEO of the ITV Denkendorf since April 2013. He emphasized in his welcoming speech that the bionics research that in the past has led to fruitful and award-winning prizes will in future also be a core theme of the work of the ITV. Bionics offers a multitude of attempts for the application-oriented research with the aim of developing innovative products from the idea up to series production readiness, in close cooperation with industrial partners.



Pic.1: Dr. –Ing Götz Gresser starts off the 5th Bionic symposium “ Bio-inspired Fiber Materials” in Denkendorf



Pic.2: Participants visiting the “Polar Bear Pavilion” at the ITV Denkendorf

Dr.-Ing. Thomas Stegmaier, Head of the research area Technical Textiles and Bionics, emphasized in his introductory speech the large bandwidth of the bionic-inspired textile research at the ITV. Current projects among others deal with fibers with abrasion resistant integrated self-cleaning functions, air-containing textiles for the reduction of friction in water, fog collectors and fluid conductors for the irrigation of plants, textile systems for the separation of oil from water and air.

The most spectacular bionic project of the ITV at the moment is without a doubt the “polar bear pavilion”. An energy-self-sufficient experimental building that gains its heating energy from textile solar panels and can store the energy in a state-of-the-art thermal storage for cold periods. The participants of the symposium had the opportunity to visit the pavilion during lunchtime. On site, project responsible Dr. Jamal Sarsour outlined the functional principles and the control engineering of the building.

In 10 technical contributions a large range of bionic research approaches and problem solutions was unfolded in the categories optimization, self-healing, architecture and lightweight structures. Thereby basic bionical research such as “plant movements as model for technical applications” (Simon Poppinga, University of Freiburg) or “Structures and sensors in the world of articulate animals (Prof. Tobias Seidel, Westfälische Hochschule Bocholt) as well as the specific implementation of “Biomimetics in architecture” (Prof. Jan Knippers, University of Stuttgart) or into industrial products as e.g. in innovative boat varnishes: “New functional coatings- biomimetics , antifouling & co.” (Dr. Juri Tschernjaew, Evonik AG, Hanau) was discussed.

The Competence Network Biomimetics Baden-Württemberg and the AFBW Allianz für Faserbasierte Werkstoffe Baden-Württemberg, where a multitude of companies are represented that are actively involved in composite lightweight construction, were cooperating partners for the biomimetics symposium.

The symposium that takes place every two years was planned by Dr. Andreas Scherrieble, who also is in charge of the Center of Bionic innovations for the Industry at the ITV Denkendorf. The Center coordinates the transfer of bionical results of research.

Bio-aided Manufacturing of Multi-scale Structures

by ZHANG Deyuan, China

The bio-aided fabrication technology is to use the metabolism function, growing process, special composites and complex structure of living creatures, to fabricate functional material, structure and apparatus from submicron to macroscopic dimensions[1]. It mainly includes three modes, the bio forming technology which directly uses abundant natural bio-prototypes to fabricate bio-shape-based structures, the bio assembly technology which uses fine structures as units to fabricate multi-scale complex structures by way of self-assembly or extra-force aided assembly, bio machining technology which uses the bio materials and bio growing processes to fabricate the recyclable and bio-transformable materials and structures.

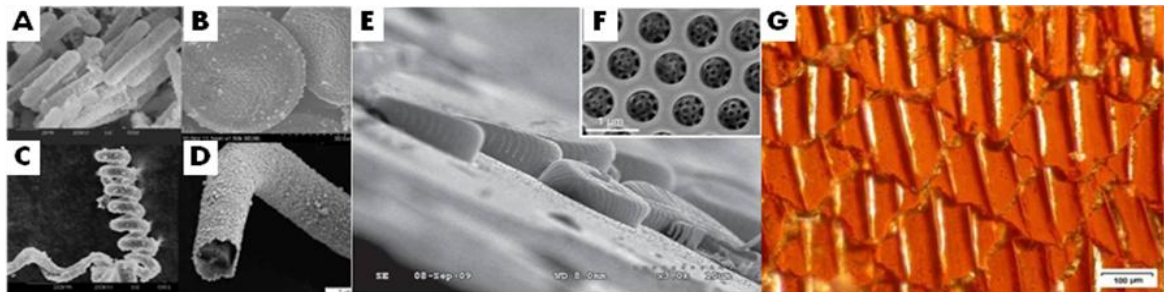


Fig 1 Functional particles, apparatus and surface made with bio-prototype aided manufacturing technology. (A) Rod-like particles made by electroless deposition of CoNiP film onto *Bacilli cereus*. (B) Flaky particles made by electroplating of Ag film onto *Coscinodiscus* diatomite. (C) Hollow spiral particles made with electroless deposition of copper film onto *Spirulina platens*. (D) The broken section view of the copper-coated *Spirulina platens*. (E) The *Cymbella perpusilla* frustules with delicate multi-scale structure were assembled and bonded onto the glass-based substrates with hydrofluoric acid-assisted bonding technique to build chips for bio-sensing use. (F) The detailed appearance with arrays of large pores (foramen) and myriad sieve pores of about 40 nm on the diatom frustules. (G) Bionic drag-reduction surface with vivid scales replicated from shark skin.

Taking the microorganism as an example, there are a large amount of microorganism species in nature; and lots of them are in specific shape and micron/nanometer dimension.

These microorganisms with different standard shapes and structures can be used as templates, then they can be made rigid and conductive or magnetic by way of depositing functional coatings onto them (Fig 1 A-D). These electromagnetic particles have more advantages when they are used as electromagnetic wave absorbing material fillers since they are in preferable shape, dimension and structure, and the fabrication process is cost-effective and high-efficient. Diatoms have strong silica frustules with transparent and delicate multiscale structures, two dimensional pore arrays, and large surface areas. And the pore size of the diatom can be further adjusted with HF acid treatment. So they can be arranged to form array or layer by assembly, then bonded with the substrate to form micro chips for biosensor, solar cells, batteries and microfluidic applications (Fig 1 E and F). Not only microorganisms, macro-scale biology can also be used as forming prototype, such as shark skin was replicated to fabricate drag-reduction surface (Fig 1G), and the drag reduction rate of this vivid biomimic surface is much higher than the bionic surface with only simplified grooves. All in one word, to fabricate multi-scale structures with bio mode is a new and multidisciplinary research field; it has prosperous vision and deserves close attention.

How does your garden glow?



Nature's ability to create iridescent flowers has been recreated by mathematicians at The University of Nottingham. The team of researchers have collaborated with experimentalists at the University of Cambridge to create a mathematical model of a plant's petals to help us learn more about iridescence in flowering plants and the role it may play in attracting pollinators.

An iridescent surface appears to change colour as you alter the angle you view it from. It is found in the animal kingdom in insects, inside sea shells and in feathers, and is also seen in some plants. Iridescence in flowers may act as a signal to pollinators such as bumble-bees, which are crucial to crop production.

Understanding how petals produce iridescence to attract pollinators is a major goal in plant biology. An estimated 35 percent of global crop production depends on petal-mediated animal pollination but a decrease in pollinator numbers across the world has started to limit the odds of pollination and reduce crop production rates.

Flowers and the animals that pollinate plants interact at the petal surface. The surfaces of many petals have regular patterns, produced from folds of the waterproof cuticle layer that covers all plant surfaces. These patterns can interfere with light to produce strong optical effects including iridescent colours, and might also influence animal grip.

Iridescence in plants is produced by nanoscale ridges on the top of the cells in the petal's epidermal surface. These tiny ridges produce structures called diffraction gratings. The particular shape and spacing of these ridges and the shape of the cells sculpt the outermost layer of the petal giving it a unique physical, mechanical or optical property. These properties interfere with different wavelengths of light creating the colour variation when it is seen at different angles. Pollinators, such as bumblebees, can detect the iridescent signal produced by petal nanoridges and can learn to use this signal as a cue to identify rewarding flowers.

The research has been published in the Journal of The Royal Society Interface. Rea Antoniou Kourouniotti, a PhD student in the School of Biosciences, said: "We provide a first analysis of how petal surface patterns might be produced. Our team of researchers combined experimental data with mathematical modelling to develop a biomechanical model of the outer layers of a petal or leaf. We used this to demonstrate that mechanical buckling of the outermost, waxy cuticle layer, can create the ridge patterns observed in nature on petals and leaves. Learning more about how iridescence is produced is important for pollination of crops and also for other types of patterning in biology."

The research was undertaken by The University of Nottingham, University of Cambridge, University of Manchester and Biotalentum Ltd, and has been published in the Journal of the Royal Society Interface. The study was initiated by the Mathematics in the Plant Sciences Study Group, an annual UK-based workshop organized by The University of Nottingham's Centre for Plant Integrative Biology, which kick-starts collaborations between plant scientists and mathematicians.

The Salvinia Effect: Stable air retention under water for drag reduction in ships

by Wilhelm Barthlott, Germany

Nowadays the rapid decline of fossil fuels, the rising fuel consumption and the negative influence on the environment by burning fossil fuels are of great interest. Therefore it is important to find possibilities to reduce the fuel consumption.

Since most of the goods are transported by ships around the world, here the shipping industry is of high interest. Ships use a considerable part of their total energy consumption to overcome friction caused by the surrounding water. This could be reduced drastically by a layer of air between the ship hull and the water.

Wilhelm Barthlott and his students and post-docs analysed by SEM and AFM surfaces of some 30 000 different plants and animals, a stock of some 250 000 SEM micrographs is in his archives. One of the most remarkable result was the discovery of the Lotus effect. But it became obvious during this work that there are different species of plants (e. g. the waterfern *Salvinia* and animals (e. g. the backswimmer *Notonecta*) capable to keep for very long periods air layers on their surfaces when submerged into water. They could proof that *Salvinia molesta* (Fig. 1) maintains a very stable air layer. The upper sides of the leaves are densely covered with complex egg-beater-like shaped hairs (Fig. 2). In close cooperation with Professor Thomas Schimmel and his working group (Institute of Nanotechnology (Karlsruhe Institute of Technology "KIT"), and Professor Alfred Leder and his partners at the Chair of Fluid Mechanics (University of Rostock) they recently discovered the Salvinia-Effect (Advanced Materials, [doi: 10.1002/adma.200904411], a paradox which causes the great



Fig. 1: Salvinia floating on a water drople



Fig. 2: Surface of Salvinia with water droplet



Fig. 3: Colored SEM micrograph with the egg beater hairs of Salvinia covered by a water layer; animation Fraunhofer-Institute

stability of the air layer: On top of each of its hydrophobic (densely covered with nano-structured wax crystals) trichomes four hydrophilic (without any wax crystals) cells are

situated (Fig. 3). The air-water-interface adheres to these hydrophilic cells. This “pinning” causes an increase of the stability of the air layer under negative pressure and prevents the extraction of air bubbles from the air layer (Fig. 4).

By recognition and abstraction of the common underlying principles it is possible to transfer the mechanism into technological application.

The aim is the development of biomimetic surfaces for long term application in naval architecture which possess a reduced frictional resistance and thereby helps to save fuel and energy. We use the principles of different species to create a biomimetic surface with the ability of long-time air retention.

First measurements with a model boat showed a drag reduction of up to 10%. Such a reduction would save up to 20 million tons of oil per year, which equals about 1 % of the oil consumption worldwide. This shows the great economic, technological and ecological interest of air retaining surfaces.

Database or Ontology?

by Julian Vincent, UK

I read somewhere that one of the hallmarks of creative people is their continual desire to make lists of everything. Sigmund Freud would say something rather less complimentary, I suspect, but lists are very useful, especially when you go shopping - whether it's for chips or new ideas. But like all tools, lists can be as limiting as they can be enlightening. The interface between biology and technology is ripe for lists, because few people know a lot about both these topics. But there are lists . . . and lists . . .



The whole article is available on the official website of ISBE (<http://isbe-online.org/>).

It is also been published in Zygote Quarterly05 on Page 102-109 http://issuu.com/eggermont/docs/zq_issue_05) which is freely available on the internet.

Upcoming Activities

WORKSHOP ON BASIC BIOMIMETICS

The International Society of Bionic Engineering (ISBE) is organizing this workshop to popularize biomimetics, its science and technology, and to spread the spirit, idea and methods of the science.

THEME: A Workshop on some of the basic methods of biomimetics

PRESENTER: Prof. Julian F. V. Vincent, University of Bath, UK

LANGUAGE: English

DATE: August 10-12, 2013

LOCATION: Nanjing, China

APPLICATION DEADLINE: July 20, 2013

WORKSHOP CONTENTS

This Workshop covers the essential thinking skills for studying biomimetics and developing biomimetic concepts. Each session lasts for about an hour and is divided into two parts - formal instruction followed by open discussion. You will be provided with a reading list to follow up what you have learned.

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Bionic Engineering Award

Ceremony

August 14, 2013 Nanjing P. R. China

ICBE 2013



The 4th International Conference of Bionic Engineering - ICBE'13 will be held on August 13-16, 2013, in Nanjing, P. R. China

Organized by

- International Society of Bionic Engineering

Sponsored by

- Nanjing University of Aeronautics and Astronautics (China)

Topics of interest

Suggested topics include but not limit to the following:

- Biomechanics
- Bionic Structure
- Biomimetic Materials
- Biomimetic Surface
- Industry applications in biomimetics
- Sensors and signal processing
- Energy systems
- Robotics, motion systems and artificial intelligence

Secretariat

Dr. Hao WANG

Tel: 86- 25-84892581 ext. 816

E-mail: icbe2013@bio-inspired-tech.com

More information is available on <http://www.icbe2013.cn>

Bionics Application Workshop

To further promote the technology collaboration and transfer in the field of bionic engineering, the Workshop on the Application of Bionic Engineering co-sponsored by Jilin University and University of Nottingham, will be held in mid-August in Changchun, P. R. China. Detailed information is as followed:

DATE: August 18, 2013

VENUE: Key Laboratory of Bionic Engineering of Ministry of Education, Jilin University, Changchun, P. R. China

REGISTRATION FEE: 500RMB

ACCOMMODATION: All the participants will be accommodated at one's own expense.

CONTENTS:

Presentations

"Science and the Study of Magnetic Field Therapy Based on Bionic Principle"

"The role of bionic and biomimetics in Mechanical Engineering: fundamental studies and applications"

"Application and Prospect of Bionic Engineering in Jilin University"

Panel Discussion

The Potential International Technical Cooperation;

How to Establish an Effective Communication Platform?

Suggestions for the International/Multilateral/Bilateral

Conference/Symposium/Workshop of Bionic Engineering in 2014, 2015 and 2016.

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BAMN 2013



The 7th World Congress on Biomimetics, Artificial Muscles and Nano-Bio (BAMN2013) will be held on August 26-30, 2013 at Jeju Island, South Korea.

The aim of the congress is to offer high-level lectures, extensive discussions and communications covering the state of the art on biomimetics, artificial muscles, and nano-bio technologies providing an overview on their potential applications in the industrial, biomedical and robotic fields. This conference is meant to create a necessary platform for an ongoing dialogue between researchers from different areas (chemistry, physics, biology, medicine, engineering, robotics, etc.) within biomimetics, artificial muscles and nano-bio technologies.

Congress Chairs, The 7th World Congress on Biomimetics, Artificial Muscles and Nano-Bio (BAMN2013)

Il-Kwon Oh Korea Advanced Institute of Science and Technology (KAIST) KOREA

Wan Doo Kim Korea Institute of Machinery & Materials (KIMM) KOREA

Ki Dong Park Ajou University KOREA

KwangJin Kim University of Nevada at Reno USA

Kinji Asaka National Institute of Advanced Industrial Science and Technology JAPAN

Jinsong Leng Harbin Institute of Technology CHINA

More information, please visit <http://www.bamn2013.org/main/>

Organized by



Robotics and Biomimetics



The IEEE ROBIO 2013 conference will take place from December 12 to 14, 2013 at Shangri-la hotel in the dynamic, beautiful, and young city of Shenzhen, China. The theme of Robio 2013 is “Robots living with human being in modern society”, reflecting the ever growing interests in research, development and applications in the dynamic and exciting areas of robotics and biomimetics.

Shenzhen, located in the Pearl River Delta and neighbouring Hong Kong, is the fastest growing city in the world and famed as the world manufacturing factory, populated by visitors from all over the world and featuring attractive tourist spots, world class conference and hotel facilities, and beautiful golf courses. Robio 2013 promises to be a great event for researchers and scholars in robotics and biomimetics, with excellent technical and social programs. The conference invites high quality original research papers in all research areas related to robotics, biomimetics and their applications.

Important Dates:

Aug. 15, 2013 Submission of original PDF full papers in IEEE format

Aug. 15, 2013 Submission of organized focused theme session proposals

Oct. 15, 2013 Notification of paper and organized session acceptance

Oct. 31, 2013 Submission of final papers and advance registration



For detailed up-to-date information, please visit the Robio 2013 conference web site:
<http://robio2013.org/>



ROMANSY-2014

XX CISM-IFToMM SYMPOSIUM on Theory and Practice of Robots and Manipulators Moscow: 23-26 June 2014

The First Symposium was held on Sept. 5–8, 1973, in Udine and this is the 20th edition. RoManSy2014 will continue this tradition, with the aim to bring together researchers, industry professionals and students from the broad ranges of disciplines referring to Robotics, in an intimate, collegial and stimulating environment.

The Symposium will be held at the Institute of Mechanical Science of RAS in Moscow.

Topics

Papers are solicited on topics related with robots within aspects of theory, design, practice and applications, including but not limited to: novel robot designs and robot components;
service robots and humanoid robots;
bio-robotics, micro and nano-robots;
kinematics and dynamics of robotic systems;
grasping, handling and intelligent manipulation
sensor systems for robots;
vision and control systems for robots;
robot prototyping, experimental robotics.

Supported by

IFToMM, International Federation for the Promotion of Mechanism and Machine Science
Institute of Machines Science - RAS in Moscow
University of Cassino and South Latium
IFToMM Member Organization of Russia

For more information. Please visit <http://romansy2014.bmstu.ru/index.php/en/>

CALL FOR SPONSORSHIP

The International Conference of Bionic Engineering(ICBE) and International Workshop of Bionic Engineering(IWBE) are premier meetings for those working on bionic engineering. They bring together researchers and developers, both academic and industrial, from around the world to share their research achievements and explore research collaborations in the fields of bionic engineering.

Sponsoring the ICBE or IWBE is an excellent way to communicate with hundreds of international researchers and exhibit to a wide range of institutions and universities from all over the world. All the members of the society have the right to apply for the sponsorship. Sponsors are requested to submit their applications to the secretariat, stating the information and assumption of your sponsorship.

All offers of sponsorship will be considered on their merits. The Board of Directors of the ISBE reserve the right to receive offers, judge the value of offers, request further information and make the decision.

If you are interested in becoming a sponsor for ICBE or IWBE, please contact us by any of the means listed below.

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*Most of the articles are provided by the members, if you have any ideas about the content, ISBE Secretariat can help you to contact the authors.