

# Newsletter

International Society of Bionic Engineering



## ISBE

## NEWSLETTER ISBE

June 2015

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Sponsored by the International Society of Bionic Engineering (ISBE)

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# Members

## CURRENT MEMBERSHIP

There are 710 individual members and 20 Corporate Members of the ISBE. Our members come from 48 countries and 6 continents of the world.

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.

More information, please visit: <http://www.isbe-online.org/?mod=info&act=view&id=648>

## Bharat Bhushan (USA)

### National Representative, ISBE

Dr. Bharat Bhushan received an M.S. in mechanical engineering from the Massachusetts Institute of Technology in 1971, an M.S. in mechanics and a Ph.D. in mechanical engineering from the University of Colorado at Boulder in 1973 and 1976, respectively, an MBA from Rensselaer Polytechnic Institute at Troy, NY in 1980, Doctor Technicae from the University of Trondheim at Trondheim, Norway in 1990, a Doctor of Technical Sciences from the Warsaw University of Technology at Warsaw, Poland in 1996, and Doctor Honouris Causa from the National Academy of



Sciences at Gomel, Belarus in 2000 and University of Kragujevac, Serbia in 2011. He is a registered professional engineer. He is presently an Ohio Eminent Scholar and The Howard D. Winbigler Professor in the College of Engineering, and the Director of the Nanoprobe Laboratory for Bio- & Nanotechnology and Biomimetics (NLB2) and affiliated faculty in John Glenn College of Public Affairs at the Ohio

State University, Columbus, Ohio. In 2013-14, he served as an ASME/AAAS Science & Technology Policy Fellow, House Committee on Science, Space & Technology, United States Congress, Washington DC. His research interests include fundamental studies with a focus on scanning probe techniques in the interdisciplinary areas of bio/nanotribology, bio/nanomechanics and bio/nanomaterials characterization and applications to bio/nanotechnology, and biomimetics. He is an internationally recognized expert of bio/nanotribology and bio/nanomechanics using scanning probe microscopy, and is one of the

most prolific authors. He is considered by some a pioneer of the tribology and mechanics of magnetic storage devices. He has authored 8 scientific books, 90+handbook chapters, 800+scientific papers (h-index – 75+; ISI Highly Cited Researcher in Materials Science since 2007 and in Biology and Biochemistry since 2013; ISI Top 5% Cited Authors for Journals in Chemistry since 2011), and 60+



technical reports. He has also edited 50+ books and holds 19 U.S. and foreign patents. He is co-editor of Springer NanoScience and Technology Series and co-editor of Microsystem Technologies, and Member of Editorial Board of PNAS. He has given more than 400 invited presentations on six continents and more than 200 keynote/plenary addresses at major international conferences.

Dr. Bhushan is an accomplished organizer. He organized the 1st Symposium on Tribology and Mechanics of Magnetic Storage Systems in 1984 and the 1st Int. Symposium on Advances in Information Storage Systems in 1990, both of which are now held annually. He organized two international NATO institutes in Europe. He is the founder of an ASME Information Storage and Processing Systems Division founded in 1993 and served as the founding chair during 1993-1998. His biography has been listed in over two dozen Who's Who books including Who's Who in the World and has received more than two dozen awards for his contributions to science and technology from professional societies, industry, and U.S. government agencies including Tribology Life Achievement Award. He is also the recipient of various international fellowships including the Alexander von Humboldt Research Prize for Senior Scientists, Max Planck Foundation Research Award for Outstanding Foreign Scientists, and Fulbright Senior Scholar Award. He is a foreign member of the International

Academy of Engineering (Russia), Byelorussian Academy of Engineering and Technology and the Academy of Triboengineering of Ukraine, an honorary member of the Society of Tribologists of Belarus and STLE, a fellow of ASME, IEEE, and the New York Academy of Sciences, and a member of ASEE, Sigma Xi and Tau Beta Pi.

Dr. Bhushan has previously worked for Mechanical Tech-

nology Inc., Latham, NY; SKF Industries Inc., King of Prussia, PA; IBM, Tucson, AZ; and IBM Almaden Research Center, San Jose, CA. He has held visiting professorship at University of California at Berkeley, University of Cambridge, UK, Technical University Vienna, Austria, University of Paris, Orsay, ETH Zurich, EPFL Lausanne, Univ. of Southampton, UK, Univ. of Kragujevac, Serbia, Tsinghua Univ., China, Harbin Inst., China, and KFUPM, Saudi Arabia.



## Yuying Yan (UK) Fellow, Deputy General Secretary, ISBE

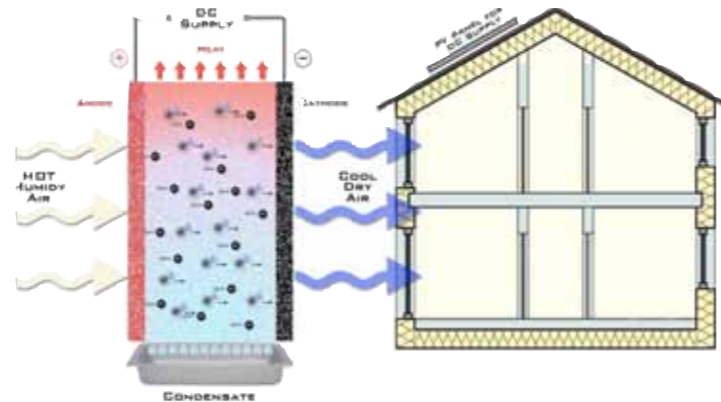
Yuying Yan is Professor (Chair) in Thermofluids Engineering and Head of HVACR & Heat Transfer Research Group in Faculty of Engineering at the University of Nottingham (UK). He also acts as Coordinator of UK-China international joint laboratory of Biomimetic Functional Surfaces and fluids, and Director of Industrial Joint Laboratory of Thermal Management & Heat Transfer for Low Carbon Vehicles at University of Nottingham.



He received BSc in 1982 at Jilin University of Technology (now Jilin University), MSc in 1986 at Shanghai Institute of Mechanical Engineering, PhD in 1996 in Mechanical Engineering at City University (London, UK). He was a research fellow in Chemical & Process Engineering at University of Surrey (UK) before being appointed to an academic position (lecturer/senior lecturer in mechanical engineering) in 1998 and promoted to Reader in Thermofluids in 2003 at Nottingham Trent University (UK). He joined the University of Nottingham since 2004 as Senior Lecturer/Associate Professor, and Reader in Thermofluids Engineering, respectively, and has been promoted to Full Professor (Chair) position since 2011.

He is a member of the UK EPSRC Peer Review College, and member of the European Research Council's Advanced Research Grant Panel, Editorial Board member of Scientific Reports (Nature Publishing Group), and Journal of Bionic Engineering; Fellow and Deputy General Secretary of the International Society of Bionic Engineering; and China Ministry of Education awarded Yangtze River Scholar (Type-B). He also serves as the Coordinator of European Marie Curie research network project

of BiApproNFS-Wett (2012-2016). He carries out wide-ranging research on fluid flow and heat transfer, and also multi-disciplinary researches of micro nano fluids, magnetic nanoparticles and ferrofluids, biomimetic surfaces and wetting, and thermal management. His major research of biomimetics includes efficient cooling technology for thermal management, modelling of surface wettability including extreme wetting using meso-scale lattice Boltzmann method (LBM), nanoparticles coating of extreme wetting surfaces (lotus leaf effect & rose petals effects) for flow & heat transfer, study water migration in plant for improve capillary effect of heat pipe wicks, hyperthermia



effect of magnetic nanoparticles as cancer therapy. His research has been supported by UK research council, Royal Society, Royal Academy of Engineering, European FP7, and industrial companies including Siemens, respectively, total funding more than £3.5 million since 2000. Prof. Yan has authored/co-authored over 200 papers in refereed journal articles, conferences, books chapters and 5 innovation patents. Scopus last 10 years' h-index: 19, i10-index: 40. He has supervised 5 post-doctors, 23 PhD students and 15 visiting scholars.

He was the Chairman of 1st international Symposium of Biomimetic-FSFI 2009, Co-Chairman of 1st, 2nd, and 3rd International Conference of Bionic Engineering (ICBE) in 2006, 2008, and 2010, respectively, and co-chair of IHTS2014. He is the organising committee chairman of 5th ICBE in 2016. Chair of IHTS2016 and Co-Chair of Heat Powered Cycle Conference 2016. He is also a member to the UK CIBSE Patrons Steering Committee, UK Network of Sustainable Innovation of Refrigeration and Air-Conditioning (SIRAC), UK Heat Exchanger Action Group (HEXAG), and Process Intensification (PIN), Micro and Nano Fluids (MNF), and management committee member of the UK Biomimetics Network for Industrial Sustainability (BIONIS). He has also been a member of the international academic adversary committees

in a number of international conferences including Heat Transfer, Multiphase flow, Micro & Nano Fluids, etc., since 2003. He was keynote speakers at international conferences of Design & Nature 2004, ICBE 2006 (plenary), 2008 (plenary), 2010, MNF2009, Multiphase Flow 2007, Multiphase Flow 2009, ICNMM2009, VTI2011, VTI2012, IMPACT2012, ISHT-8 (2012), ICBE2013, also IHTS2014 (plenary speaker) and AFMC2014 (plenary speaker). He also serves as an external advisor/examiner at a number of universities in the US, UK, Australia, Singapore, and Hong Kong for academic staff promotion, research assessment and PhD examinations over the last 10 years.

### Recent Plenary/Keynote at International Conferences

1. Yuying Yan, Invited Keynote Lecture at I2CNER Annual Workshop of Thermal Science, Kyushu University, Japan, 4 February 2015 on useful lessons from nature for improving energy efficiency and sustainable development – Carrying out cutting edge research at Nottingham.
2. Yuying Yan, Invited plenary lecture at The 19th Australia Fluid Mechanics Conference (AFMC), 8-11 December, 2014, Melbourne, Australia on “Nature inspired solutions of energy efficiency - the past, the current and the future”.
3. Yuying Yan, Keynote lecture at Bionic Special Session in World Agricultural Congress (CIGR2014), 17 September 2014, Beijing on “What can we learn from the study of water migration in plants”.
4. Yuying Yan, Plenary lecture at Sustainable development conference, ICBFE2014, 4-5 July 2014, Nottingham on “Useful lessons from nature for improving energy efficiency and sustainable development”.
5. Yuying Yan, Plenary lecture at International Heat Transfer Symposium, IHTS2014, 6-9 May 2014, Beijing on “Natural solutions help improving heat transfer”.



# News and Events

## Julian Vincent awarded the Honorary Professorship

On Friday the 23rd of January 2015, in recognition of his extraordinary contribution to science, the Rhine Waal University of Applied Sciences awarded to Prof. Dr. Julian Vincent, the president of ISBE, the first Honorary Professorship in its Faculty of Technology and Bionics.

Cleves/Kamp-Lintfort, 26 Jan 2015: The Faculty of Technology and Bionics of

the Rhine Waal University of Applied Sciences awards to Prof. Dr. Julian Vincent, Visiting Lecturer for "Ontology in Biomimetics" and "Biomimetic Product Design", its first Honorary Professorship. Prof. Vincent is one of the pioneers of the field of biomimetics, has an excellent reputation as an expert in the field, has registered several patents, and has been awarded several honorary titles by institutions worldwide. At Rhine Waal he is helping to develop the curriculum of the masters degree in Bionics/Biomimetics and has been teaching for three semesters in the Faculty of Technology and Bionics. "The field of bionics plays an important role in all of our degrees. We are delighted to welcome excellent researcher and teacher Prof Vincent, who so ably communicates the interdisciplinary requirements of his field," says the Dean of the faculty of Technology and Bionics, Prof. Dr. Ing. Thorsten Brandt.



An internationally renowned researcher in the field of Biomimetics, Prof. Vincent, then employed by the Department of Zoology at the University of Reading, together with Prof. George Jeronimidis from the Department of Engineering, founded in 1991 the first research centre for biomimetics in the world. This successful venture employed 15 researchers and staff and was funded 60% by industry. The centre ran numerous interdisciplinary projects in many areas of research, and published a significant number of research papers.

Furthermore Prof. Vincent has given a great number of international research seminars, is a member of several research groups, and has published many specialist articles. "The mutually beneficial collaboration of Universities and Industry, of students, professors and industrialist was and is my most important goal. I firmly believe that students should be trained as practically and future-oriented as possible, with a solid, broad base in their field," says Prof. Vincent.

The award of the Honorary Professorship to Prof. Vincent was made by the VC of the Rhine Waal University of Applied Sciences, Prof. Dr. Marie-Louise Klotz. The laudatory speech was made by the Dean of the Faculty of Technology and Bionics, Prof. Brandt.

## Meeting of ISBE Board of Executive Directors

The Meeting of ISBE Board of Executive Directors 2015 was successfully held at Instituto Superior Técnico, Lisboa, Portugal on April 14th. Julian Vincent, the President of ISBE, Luquan Ren, Standing Vice-President, Thomas Stegmaier, Vice-President, Jianqiao Li, General Secretary, Yuying Yan, Deputy General Secretary, Ana Moita, Portugal Representative, and Runmao Wang, Director of the Office of Secretariat, ISBE attended the meeting.

The meeting was chaired by Julian Vincent. The topics including International Workshop of Bionic Engineering 2015 (IWBE2015), Biomimetic Workshop in 2015, EU Network Workshop in Lisbon, Bionic Engineering Award 2016, Regular election of the Board of Directors in 2016, membership dues and donations, and construction of the bionic database among others was discussed.

The full meeting minutes is open to the members now and able to be downloaded from the website now.



## ISBE Group visits Portugal and Spain

On April 13-24, 2015, a visiting group consisting of 3 persons led by Professor Luquan Ren, the Standing Vice President of the ISBE paid a visit to Portugal and Spain for academic exchange and cooperation at invitation.

In Portugal, the group met Dr. Ana Moita, Portugal Representative of ISBE, at Instituto Superior Técnico, Lisboa. Both of them expressed the expectations of the future cooperation. During the visit, the Meeting of the Board of Executive Directors 2015 was held. Afterwards, the group visited the IN+ Center for Innovation, Technology and Policy Research at Instituto Superior Técnico.



During the visit in Spain, the group visited Instituto de Ciencia de Materiales de Madrid, CSIC in Madrid. Prof. Jianqiao Li, the General Secretary of the ISBE, was invited to make presentations. Both sides exchanged their ideas on biomimetics and reached consensus. They also expressed their wishes of further cooperation in the fields of common interests.



## New Head at the University of Nottingham Ningbo China

Professor Chris Rudd (UK Representative of ISBE), a new Pro-Vice-Chancellor and Provost takes over at The University of Nottingham Ningbo China (UNNC) this summer.

He will lead the University – which has just celebrated its tenth anniversary – into its next phase of development.

He succeeds Professor Nick Miles OBE, who is returning to the UK after five highly successful years in charge of UNNC.

Professor Rudd, Pro-Vice-Chancellor for External Engagement since 2007, has extensive experience of senior academic management. As Professor of Mechanical Engineering, he has worked extensively with China's emerging corporate sector to build long lasting partnerships that benefit both countries – meeting China's needs for technology and talent and the western need for new markets.

Professor Rudd has launched many high-value partnerships and created Nottingham's Asia Business Centre to sustain those collaborations. He led Nottingham's presence at the 2010 Shanghai

World Expo and chairs the Nottingham Confucius Institute. He is also a Board Director of the China Britain Business Council and a guest Professor at Jilin University.

In 2013 he was awarded the Changbaishan Friendship Award by the Chinese Government. He is a regular speaker at Sino-UK business events, promoting partnership, transnational education and the role of universities in building cultural and economic bridges and supporting business growth.

Professor Sir David Greenaway, Vice-Chancellor of The University of Nottingham, said: "This change in leadership comes at an exciting time for UNNC and our collaborations in China more widely. Nick's visionary leadership will leave a lasting legacy for past and future generations of students and alumni, and a secure platform for Professor Rudd to build on."

"I am delighted Professor Rudd will be our new Provost. He is an experienced PVC with extensive knowledge of working in China. I am confident UNNC will go from strength to strength under his leadership."

### WRITE TO US



### Send an email to ISBE Secretariat

ISBE Secretariat is always calling for news and ideas among our members, if there is any information you would like to include in the future edition of newsletter, please feel free to contact us.

Email: [secretariat@isbe-online.org](mailto:secretariat@isbe-online.org); [office@isbe-online.org](mailto:office@isbe-online.org)

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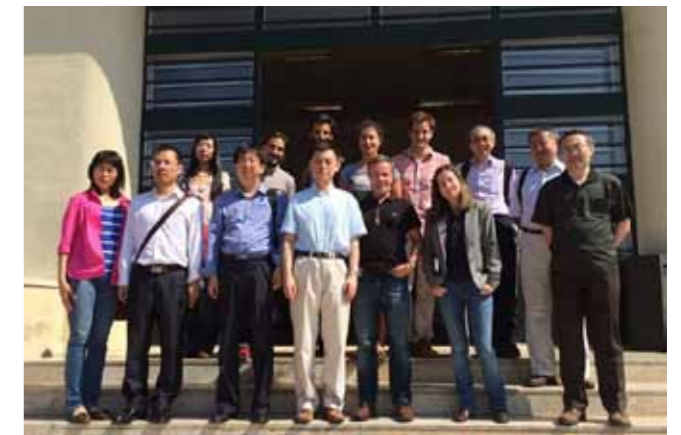
## 4th BioApproNFS-Wett Workshop

The 4th BioApproNFS-Wett Workshop was held at Instituto Superior Técnico, in Lisbon, Portugal, on the 4th and 5th June, 2015.

The workshop, hosted by the Multiscale Transport Phenomena Laboratory of IN+ was organized in the context of the network of the Marie-Curie project "BioApproNFS-Wett - Biomimetic Approaches of Natural Functional Surfaces with hierarchical micro & nano structure and the extreme Wettability".

Invited speakers from the University of Nottingham, Liverpool John Moores University, Instituto Superior Técnico and from the Key Laboratory of the Ministry of Education for Bionic Engineering, at Jilin University, gave in total 10 lectures divided in three main sessions: Session I - Micro-structured & bioinspired surfaces for extreme wetting scenarios: Manufacturing; Session II - Micro-structured & bioinspired surfaces for extreme wetting scenarios: Applications; Session III - Bionics and Biomimetics in Engineering.

The workshop ended on 5th June, after a visit to the Laboratory of Thermofluids Combustion and Energy Systems of IN+ and particularly to the Multiscale Transport Phenomena Laboratory, where the workshop participants were able to see the various experiments and equipment working in situ and discuss with the researchers working at the lab in a more informal environment.



## 2015 International Workshop on Agricultural Robotics and Automation



Invited by Prof. Kyeong-Hwan Lee, the director of Agricultural Robotics and Automation Research Center, Chonnam National University, Prof. Jianqiao Li, the General Secretary of the ISBE attended the 2015 International Workshop on Agricultural Robotics and Automation held in Cheonan, Korea, on June 10-14 and presented a Plenary Lecture entitled "Application and Prospect of the Bionics in Agricultural Machinery in China".

Prof. Li visited the Farming Automation Division and Agricultural Safety Engineering Division of Department of Agricultural Engineering, National Academy of Agricultural Science of Korea after the workshop, and he visited the Agricultural Robotics and Automation Research Center of Chonnam National University as well.

# Bionic Engineering Award



The International Bionic Engineering Award is presented by the International Society of Bionic Engineering (ISBE) at its triennial Conference to honour members of the society who have made an outstanding contribution to bionic engineering. Members of the Executive Board of ISBE are not eligible.

## Sponsor

Bionic Engineering Award is sponsored by the members of ISBE voluntarily to reward the members who make outstanding contributions to bionic engineering research. It is presented at the International Conference of Bionic Engineering held every three years.

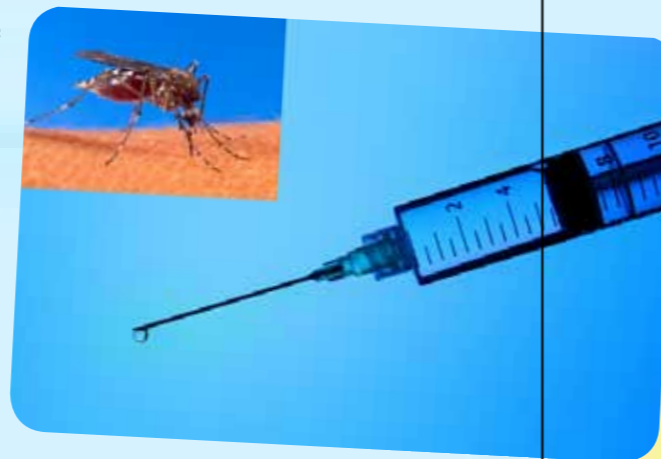


**Luquan Ren**



**Julian Vincent**

The award in 2016 is donated by Prof. Luquan Ren, Member of Chinese Academy of Sciences (CAS), P. R. China and Standing Vice Preside of ISBE and Julian Vincent from the University of Oxford, UK and the president of ISBE.



## The Award consists of three categories

- 1) Outstanding Contribution Award: Two winners, each one will be awarded 20,000 -30,000 RMB and a Certificate;
- 2) Outstanding Youth Award: Two winners under 40 years old, and each one will be awarded 10,000-20,000 RMB and a Certificate.
- 3) Outstanding Student Award: Two winners, and each one will be awarded 5,000-10,000 RMB and a Certificate.

## Qualifications

### 1) Outstanding Contribution Award and Outstanding Youth Award:

- a. The winners shall have contributed remarkable research achievements in bionic engineering;
- b. The winners shall have made great progress in scientific research, community service, technology transfer, etc in bionic engineering;
- c. The winners shall have made a prominent contribution to the promotion of science and technology, international communication and collaboration, etc in bionic engineering.

### 2) Outstanding Student Award:

- a. The winners shall be the students majored in a bionic academic discipline;
- b. The winners shall show outstanding scientific and research qualities;
- c. The winners shall have made remarkable research achievements in bionic engineering.

## There are three methods of nominating candidates

- 1) Nomination by the Candidate;
- 2) Nomination by another member;
- 3) Nomination by a group of colleagues.

All nominations must be accompanied by the Application Form. Nominations from another member or group of members must also include a statement of recommendation. Application for an Outstanding Student Award should also provide a scanned copy of student ID card. A Nominee must be a member of the ISBE at the time of nomination.

Nominations can be submitted by e-mail to [secretariat@isbe-online.org](mailto:secretariat@isbe-online.org) or [office@isbe-online.org](mailto:office@isbe-online.org) or by post to 1202 Administrative Building, Jilin University, 2699 Qianjin Street, Changchun 130012, P. R. China. The deadline for submission of nominations is September 30, 2015, unless otherwise indicated.

The Award Committee will be established following the guidelines of Award Measures. Nominations will be assessed on the nominee's merits and eligibility. The results will be announced at the 5th International Conference of Bionic Engineering (ICBE2016, June 21-24, 2016, Ningbo, P. R. China) when the winners will be presented with their award.

# Research Reports

## Fabrication of Functional Superhydrophobic Engineering Materials via an Extremely Rapid and Simple Route

GUO Zhiguang, China

Superhydrophobicity, usually defined as a property with water contact angle larger than  $150^\circ$ , is known as an extreme state of wettability. Up to now, plentiful methods have been put forward to fabricate superhydrophobic surfaces on various substrates. As important and irreplaceable engineering materials, metals are widely used in our daily life. Therefore, fabricating superhydrophobic surfaces on metal materials is of great significance, and applicable methods for industrial production are in urgent need. However, when involved with industrial production, low cost, simple procedures, high efficiency and mass production are considered as the most important factors. Guo et al reported an efficient, economical and eco-friendly route to fabricate superhydrophobic films on engineering metal materials via simple displacement deposition process. The as-prepared superhydrophobic coating is homogeneous, flexible and repairable, which has potential application

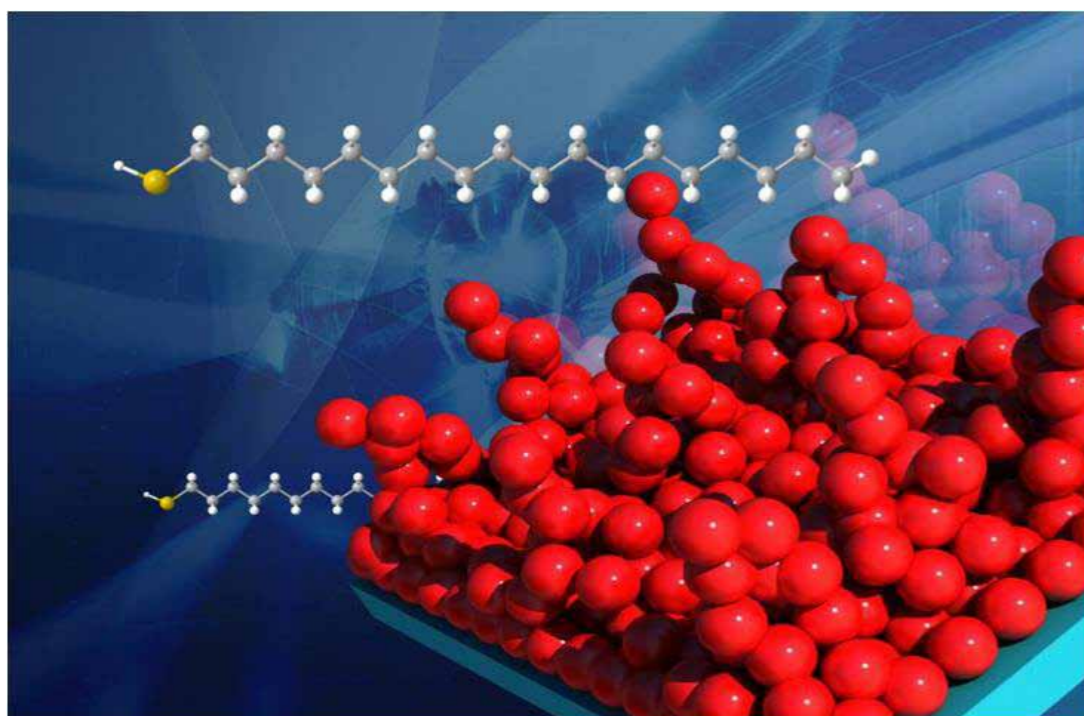


Fig. 1 Three-dimensional diagrammatic drawing of the as-prepared superhydrophobic

in buoyancy increasing and oil spill clean-up areas. In Fig. 1, a three-dimensional diagrammatic drawing perfectly reflects the structures of the superhydrophobic film deposited on zinc plate.

The whole process is extremely simple and fast, which includes two steps as follows. Take zinc substrate for example, zinc plate was first immersed into an aqueous solution of  $\text{CuCl}_2$  and  $\text{HCl}$  at room temperature for 1 second. Due to the strong acid atmosphere, the displacement reaction is extremely fast. Subsequently, the zinc plate was immersed in ethanol solution of octadecanethiol for modification, which also took 1 second. Eventually, a superhydrophobic film on zinc substrate was fabricated in less than 1 minute. As for copper substrate, the procedures resemble to that of zinc except replacing  $\text{CuCl}_2/\text{HCl}$  solution with  $\text{AgNO}_3/\text{HNO}_3$ . Both of the films on zinc and copper substrates show excellent superhydrophobicity (Fig. 2).

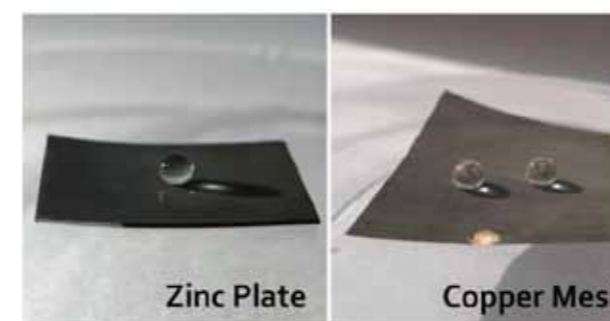


Fig. 2 Photos of droplets on as-prepared superhydrophobic films

In nature, water-strider can skate on the water, which is attributed to its superhydrophobic feet. Inspired by that, we conducted an interesting experiment to verify and quantize the buoyancy increasing property of the obtained superhydrophobic films. They made a miniature boat (43mm in length and 14mm in width) with a zinc plate (Fig. 3). We placed the miniature boat on the water and increased its load. The final load capacity of the miniature boat is in proportion to its buoyancy. The results showed that the superhydrophobic coating increased the load

capacity by 20.9% (Fig. 3). The buoyancy increasing property could be attributed to the existence of air layer between water and boat. In our work, the simple process and the flexible substrates make it possible for fabricating superhydrophobic coatings on metal materials of any reasonable shape and size, which is particularly applicable in the production of watercraft and hydromotive robots.

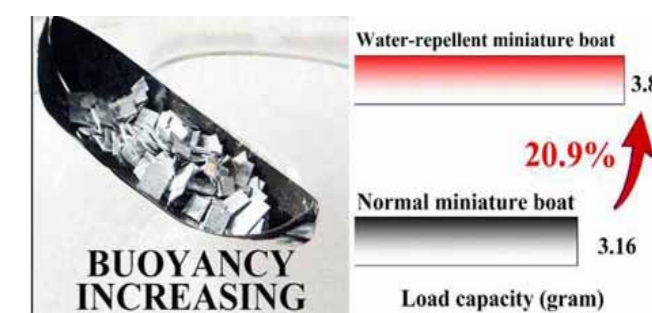


Fig. 3 Buoyancy increasing property of as-prepared superhydrophobic films

Oil spill up accidents usually cause destructive damage to the marine ecosystem. Fortunately, superhydrophobic materials can be a practical solution to oil-spill problems. In our work, we provide an eco-friendly, economical and efficient route to fabricate superhydrophobic copper mesh for oil-spill clean-up. The superhydrophobic copper mesh can efficiently absorb oil floating on water with considerable recycle times. With large-scaled production and application of superhydrophobic materials, the pollution and damage caused by oil-spill will be controlled and eliminated in time.

Through exhaustive experiment, they have proved the method works for copper and zinc. They also speculated that the employed method can be applied to other metals. In addition, solution-immersion process is not the only option, spraying and brush coating is also feasible, which indicates promising prospect of large-scale application in our daily life and industrial production.

The detail content is published in Chem. Commun. 2015, 51, 6493. as an inside cover paper.

# Experimental Investigations of the Barn Owl's Gliding Flight

Andrea Winzen, Michael Klaas, Wolfgang Schröder, Germany

The increasing interest in the development of small flying drones, so-called micro air vehicles (MAV) has caused a strong need to thoroughly understand low-speed aerodynamics. The barn owl (*Tyto alba*) (Fig. 1) is able to perform highly maneuverable low-speed gliding flight and as such is an example of how nature has evolved strategies to overcome the well-known problem of flight in the low Reynolds number regime. Thus, it is predestinated to inspire the development of future MAVs.



Figure 1: Barn owl in gliding flight.

The geometry of the barn owl wing indicates that it is specially designed for low-speed gliding flight since its shape is characterized by an almost elliptical planform and a wing size which is greater than that of birds of comparable weight, e.g., the pigeon. Furthermore, it possesses three unique features, namely the leading-edge serrations, fringes at the inner vane of each feather and the trailing-edge of the wing, and a velvet-like surface structure on the suction side (Fig. 2).

Presently, fundamental research to understand the features which enable the barn owl to perform its characteristic stable and at the same time silent gliding flight is being carried out at the Institute of Aerodynamics of RWTH Aachen University, Germany.

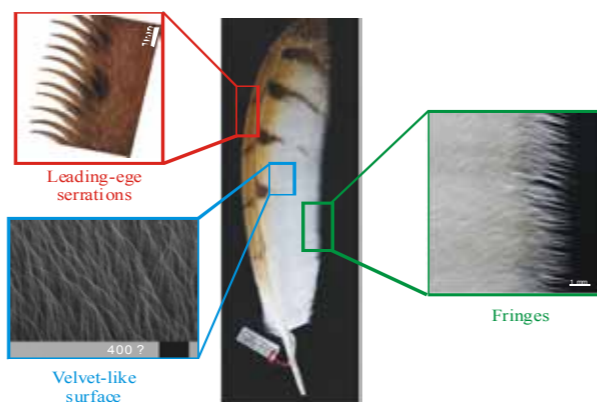


Figure 2: Special adaptations of barn owl feathers.

The special features of the owl are mimicked by technical replica and applied to wind tunnel models, the geometry of which is based on three-dimensional surface scans of prepared natural barn owl wings. Thus, they resemble the geometry of a natural wing in gliding flight without the owl-specific adaptations.

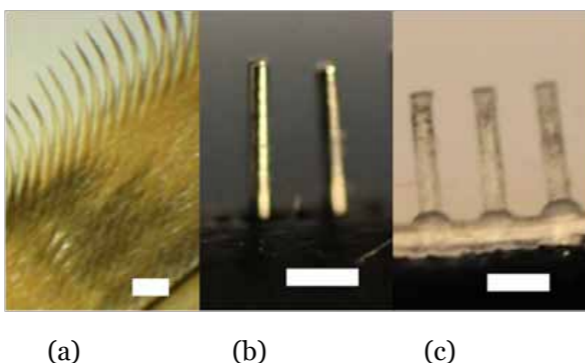


Figure 3: Leading-edge serrations; (a) natural, (b) metal, and (c) silicon. The white bar represents 1 mm.

Figure 3a shows the natural leading-edge serrations which are imitated by metal rods (fig. 3b) and silicon strips (fig. 3c), the geometry of which is based on the natural pattern. The velvety

structure on the suction side is replicated by artificial textiles which are selected based on their similarity to

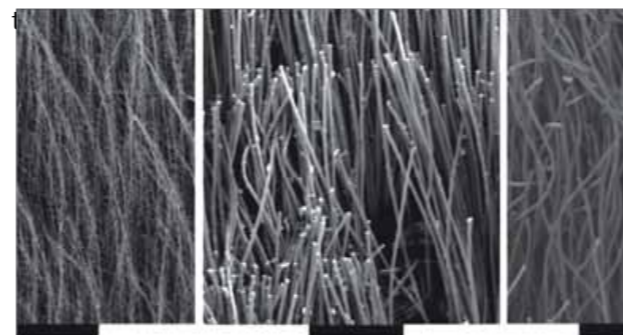


Figure 4: Velvet-like surface structure; (a) natural, (b) artificial surface 1, and (c) artificial surface 2. The black bar represents 400  $\mu\text{m}$ .

To evaluate the interaction of all owl-specific wing adaptations in combination with additional aspects as porosity and flexibility of the wing structure, the flow field of a prepared natural wing is currently investigated as shown in fig. 5.

In the course of the project, the aerodynamic characteristics of the owl wing are analyzed by the means of flow visualization techniques like oil flow pattern and pressure measurements for the clarification of the basic flow phenomena, laser-based optical measurement methods as particle-image velocimetry (PIV) for the detailed analysis of the flow field around the wing, and force measurements to evaluate the overall aerodynamic forces acting on the wing.

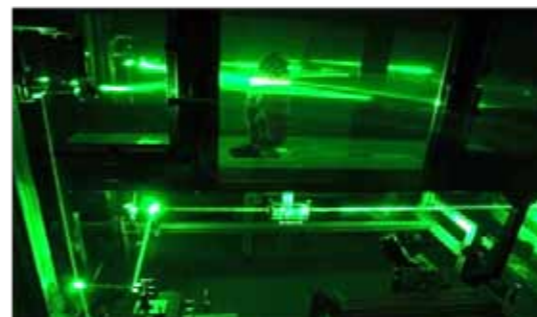


Figure 5: PIV-measurement on a natural owl wing. Generally, the investigations indicate a stabilizing effect of the owl-specific adaptations on the flow field. This is exemplarily shown for a flight velocity of  $u_\infty = 5.5 \text{ m/s}$  and an angle of attack of  $\alpha = 3^\circ$  (fig. 6). The averaged velocity field of the clean model without any

adaptations shows a region of flow separation (fig. 6a) which is significantly reduced by the application of the textile (fig. 6b).

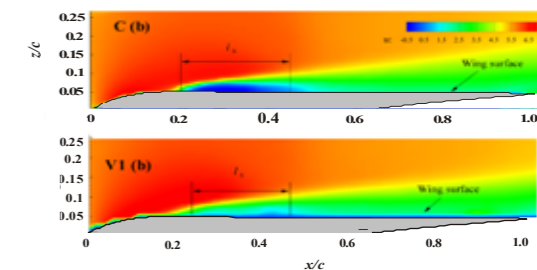


Figure 6: Average velocity field for  $u_\infty = 5.5 \text{ m/s}$ ,  $\alpha = 3^\circ$  for the clean (top), velvet 1 (bottom) configuration.

The surface structure also decreases the size and strength of vortical structures shed by the separation bubble as depicted in fig. 7.

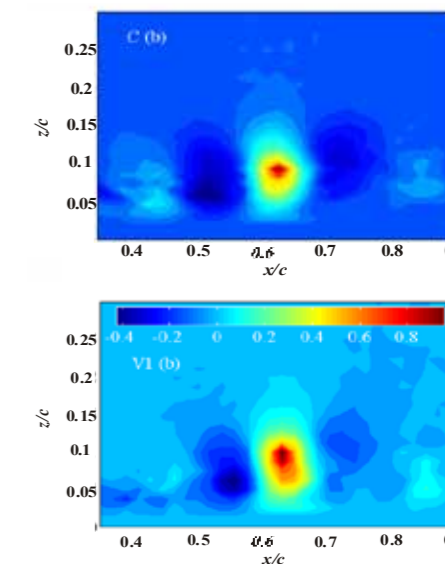


Figure 7: Two-point correlation of the wall-normal velocity fluctuations for  $u_\infty = 5.5 \text{ m/s}$ ,  $\alpha = 3^\circ$  for the clean (top) and velvet 1 (bottom) configuration.

Also, a similar lift-to-drag ratio is found when the owl-specific features are applied, leading to a nearly constant aerodynamic performance independent of the flight velocity.

In conclusion, the current investigations indicate a stabilizing effect of the special adaptations concerning local flow phenomena and global aerodynamic forces which might offer a significant potential for the application in future MAV design.



## Phytomining

Ille C. Gebeshuber, Malaysia

Most of us have already heard about bioremediation. In bioremediation, organisms are used to remove (or render inactive) toxic substances in the soil or in water. An example for bioremediation is the use of certain plants that accumulate metals in their tissues when growing on heavy metal polluted soils. Zinc, Nickel, Lead, Cadmium or Caesium are accumulated in plants such as *Thlaspi caerulescens* (Alpine Pennycress, also known as Alpine Pennygras) or *Amaranthus retroflexus* (Redroot Amaranth). In this way, the toxicity of the soil, e.g. in areas that are contaminated from conventional mining, can be reduced to a great extent. Bioremediation is commercially applied in various regions of the Earth, with a US market size of about \$7-8 billion annually.

Some of the plants that accumulate metals can accumulate such huge amounts of metal that they can in fact be used for a new way of mining: mining with plants. The plants can for example be planted in areas where the metal concentration is too low for conventional mining. *Vitotia neurophylla*, an endemic plant of New Caledonia that is unfortunately threatened by habitat loss, can for example hyperaccumulate Manganese in an amazing concentration of 55000 mg/kg dry plant material! Plant hyperaccumulators are known for Nickel, Cobalt, Copper (our beloved sunflower is a hyperaccumulator of Copper!), Zinc, Cadmium, Gold (induced hyperaccumulation), Manganese, Lead and Thallium. Furthermore, plants, fungi and bacteria can produce metal or metal oxide nanoparticles, such as Selenium nanoparticles



The sunflower *Helianthus annuus* can be used in a new way of mining metals: phytomining – mining with plants

(NPs), Platinum NPs, Silver NPs, Gold NPs, TiO<sub>2</sub> NPs and ZnO NPs, with sizes from some nanometers up to several hundreds of nanometers.

Heavy metal loaded effluents from industry could be the base material for metallic nanoparticles used in nanoscience and nanotechnology. Plants (such as the sunflower plant) and microorganisms (such as bacteria, fungi, algae, and yeast) can be used to accumulate these heavy metals and to safely remove the pollutants from the water and the soil. The first goal regarding heavy metal effluents should be their prevention. However, in cases where they cannot (yet) be completely prevented, biomimetics

can come into the game: we could learn from living nature how to deal with such effluents not by treating them as waste but by treating them as resource (waste-to-wealth concept). Metallic nanoparticles are currently used in important nanotechnology research areas and are also heavily used in applications. They are important (and acceptable) in our current early phases of nanotechnology research and development, where we need to understand the basics. Future resource management might increasingly realize the paramount biomimetic principle of “shape rather than material” to achieve functionalities that

are currently fulfilled by unsustainable metal- and plastic-based resources by benign materials that would allow for sustainable engineering. Apart from biomineralized structures and specific biomolecules, where the chemistry (as opposed to the physics) of the metal is necessary for the function (such as in haemoglobin or chlorophyll), living nature rarely uses metals. In most cases, elaborated structures from hierarchically composed metal free materials yield the functionality that we, with our current conventional engineering, mainly achieve with the use of many different materials, including metals.

## Bionic Geomagnetic Navigation

WU Wenjian, China

Many animals have the miraculous ability of geomagnetic navigation. After forty years of study, animal magnetoreception is still far from well understood. It has never been demonstrated that a static magnetic field as weak as that of the Earth (~50μT) can produce detectable changes in living things or artificial molecular systems at physiological temperature.

Our group aims to construct a geomagnetic sensor that will work like an animal's magnetic compass. Up to now, the following experiments have been performed:

1. Obtaining a geomagnetic sensitive protein from pigeon. A new member of magnetosensitive protein, cryptochrome 1 (*CiCry1*), isolated from *Columba livia*, has been cloned and expressed successfully. The key cofactor, flavin adenine dinucleotide (FAD), is bound non-covalently to the protein in its semireduced state.
2. Signal transduction in an organism. With yeast two-hybrid experiments and high-throughput sequencing, we have isolated seven proteins that interact with *CiCry1*. Understanding the downstream receptor protein *in vivo* is critical to get an amplified signal in developing a bionic geomagnetic sensor.
3. Designing and synthesizing a bionic molecule as a chemical magnetic compass. Based on the biological mechanism and the structure of the protein, a series of ternary compounds have been synthesized with flavin and Trp connected by a carbon chain. Different number of carbon atoms in the bridge chain can adjust the separation between electron donor and receptor as happens in the protein.
4. Testing and verifying the geomagnetic response. Using transient fluorescence spectroscopic observation at room temperature, we see that both the protein *CiCry1* and the bionic molecule are sensitive to applied magnetic fields ranging from 50 to 300μT, the approximate strength of the Earth's field or a little above, but there is no measurable response to a magnetic field above 1 mT. This is the first report of a magnetic response of a protein in so weak a magnetic field at room temperature.



# Upcoming Activities

## Optimisation and "trade-off" in Biomimetics Workshop by Professor Julian Vincent, University of Oxford

The International Society of Bionic Engineering presents this workshop to enhance understanding of biomimetics, its science and technology, and to spread the spirit, ideas and methods of the science.

**LANGUAGE:** English

**DATE:** October 10-11, 2015

**LOCATION:** Key Laboratory of Bionic Engineering (Ministry of Education), Jilin University, 5988 Renmin Street, Changchun, P. R. China

**REGISTRATION FEE:**

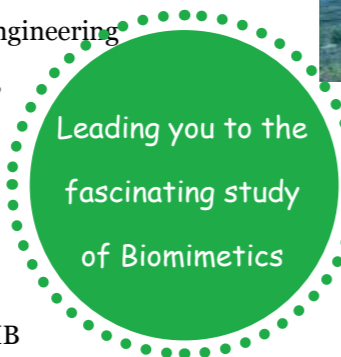
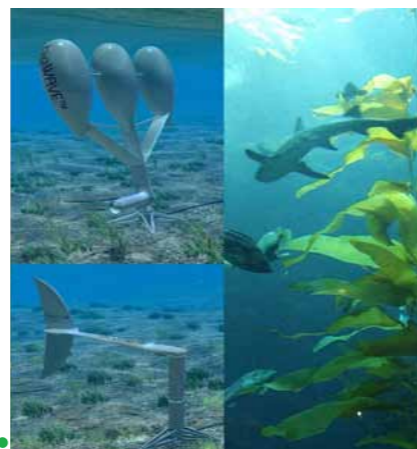
Delegate/Participant: 500RMB

Student/ Accompanying Person: 200RMB

**ACCOMMODATION:**

All the participants will be accommodated at their own expense

**APPLICATION DEADLINE:** September 10, 2015



### Learn from Nature

**CONTACT:** TIAN Ximei

Office of Secretariat , ISBE

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office@isbe-online.org

Web: <http://www.isbe-online.org/>

#### PRESENTER: Prof. Julian F. V. Vincent

Julian F. V. Vincent is the President of the ISBE. His primary training was in zoology, but he has also been a Professor of Mechanical Engineering. He has published over 320 papers, articles and books covering aspects of mechanical design of plants and animals, complex fracture mechanics, design of composite materials, use of natural materials in technology, advanced textiles, deployable structures in architecture and robotics, smart systems and structures. His book Structural Biomaterials is a standard text.

# IWBE 2015

## 2015 International Workshop on Bionic Engineering

October 14-16, 2015 Beijing, P. R. China

### Call for papers

The 2015 International Workshop on Bionic Engineering will be held in Beijing at the Beihang University campus, 14-16, October 2015. This workshop aims to provide an international forum for scientists and engineers around the world who are working in the field of bionic engineering to present and share their ideas and latest works. The theme of IWBE 2015 is "The Progress and new Challenges of Bionic Functional Structures and Surfaces".

Authors are invited to submit abstracts covering, but not limited to, the following areas:

**Biomimetic surface; Bionic smart systems; Bio-inspired micro/nano structure fabrication and bio-manufacturing**

#### Advisors

Julian F V Vincent, Professor  
University of Oxford, UK

Ren Luquan, Professor & Member of CAS  
Jilin University, P. R. China

Jiang Lei, Professor & Member of CAS  
Beihang University (BUAA), P. R. China

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Zhang Deyuan, Professor  
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Cai Jun, Professor, Deputy Dean  
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National Natural Science Foundation of China

#### Important Dates

Jul. 31, 2015 Deadline for Abstract Submission

Aug. 20, 2015 Acceptance notification

Sept. 15, 2015 Deadline for Final Contribution

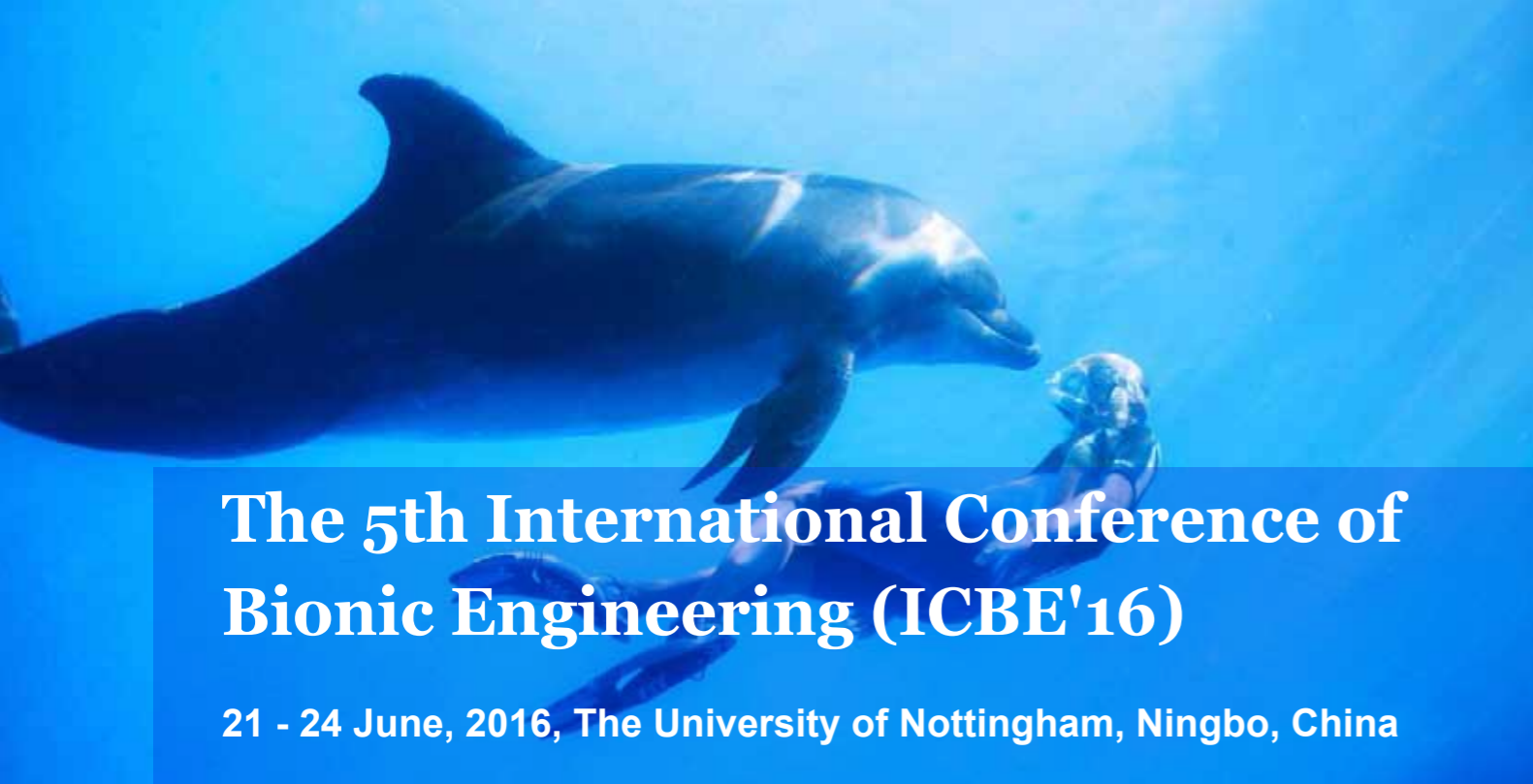
Oct. 14-16, 2015 Workshop in Beijing, China

#### Submission & Contact

All abstracts are invited to be submitted by email to [jun\\_cai@buaa.edu.cn](mailto:jun_cai@buaa.edu.cn), [chenhw75@buaa.edu.cn](mailto:chenhw75@buaa.edu.cn). The abstract should focus on the motivation, major results and conclusions with 1000 English word limit and single-spaced style. The abstract is better to be organized within 1 page.

Please check on the official website (<http://www.isbe-online.org/?mod=info&act=view&id=927>) regularly for any update about the conference, or contact Associate Prof. Huawei CHEN for any inquiries at [chenhw75@buaa.edu.cn](mailto:chenhw75@buaa.edu.cn).





# The 5th International Conference of Bionic Engineering (ICBE'16)

21 - 24 June, 2016, The University of Nottingham, Ningbo, China

## CALL FOR PAPERS

The 5th International Conference of Bionic Engineering organised by the International Society of Bionic Engineering (ISBE) will be held in Ningbo at the University of Nottingham Ningbo (UNNC) campus, 21 – 24, June 2016. This conference aims to provide an international forum for scientists and engineers around the world who are working in the field of bionic engineering, and also for dissemination of information and knowledge exchange in biomimetics and bionic engineering. A broad range of topics and application areas will be devised to reflect the interdisciplinary nature of this conference.

**Authors are invited to submit abstracts covering, but not limited to, the following areas:**

- Biomechanics
- Bionic structures
- Biomimetic materials
- Biomimetic Surfaces
- Fluids flow and drag reductions
- Nature inspired designs
- Industrial applications in biomimetics
- Sensors and signal processing
- Energy systems
- Robotics, motion systems and artificial intelligence

### Important Dates:

Abstract submission:	8 Oct 2015
Notification of accepted abstracts:	10 Nov 2015
Full paper submission:	30 Jan 2016
Notification of accepted full papers:	20 Apr 2016
Early bird Registration deadline:	20 March 2016

SUBMIT  
YOUR 300 Word  
Text  
Only ABSTRACT BY  
8 Oct, 2015  
TO: <http://icbe2016-unnc.org>

### Honorary Chair of the Conference:

Professor Luquan REN, Academician of CAS at Jilin University, China, Standing Vice-President of ISBE  
 Professor Christopher Rudd, Pro-Vice Chancellor of University of Nottingham, UK, and Provost of University of Nottingham Ningbo, China

### Conference Chair:

Professor Yuying Yan, University of Nottingham, UK  
 Professor Michael George (co-Chair), University of Nottingham Ningbo, China  
 Professor Jianqiao Li (co-Chair), Jilin University, China, General Secretary of ISBE

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Please check on <http://icbe2016-unnc.org> regularly for any update about the conference, or contact the conference office for any inquiries at [info@icbe2016-unnc.org](mailto:info@icbe2016-unnc.org)





## Call for Papers

Share your latest achievements in research, technology and new applications with leading-edge experts at

### Symposium

Mining Smartness from Nature:

From Bioinspired Materials to Bionic Systems  
of the 5th International Conference

Smart and Multifunctional Materials, Structures  
and Systems

CIMTEC 2016

June 5-9, 2016, Perugia, Italy



Novel and efficient materials, structures, tools, mechanisms and processes have already resulted from adapting mechanisms and capabilities from nature and more may be envisaged for the near future because of the increased understanding of the biological world, the capability to manage matter down to the atomic scale, the development of novel algorithms and theories, and the exponentially increasing power for computation and multi-scale simulation of processes, materials, structures and whole systems. Objective of this symposium, that follows the ones on the same subject held at previous CIMTEC Conferences, is to merge biological information with materials science, engineering and medical sciences at the purpose of exploring new ideas and accomplishments for the practice of bio-inspired design to gather momentum and offer innovative solutions.

**Abstract deadline: October 15, 2015**

**Submit your Abstract**

Only one abstract may be submitted by the same Presenting Author

CIMTEC 2016 will gather together a large and qualified audience of materials scientists, physicists, chemists, biologists, physicians and engineers, as well as experts of a wide range of the most advanced and demanding research and application areas of smart materials and related technologies. On the top of this premier event in materials, the Umbria region will offer its wonderful landscape and its immense, unique artistic heritage!

Learn more about CIMTEC Conferences: <http://www.cimtec-congress.org/>





## 6th International Conference on Mechanics of Biomaterials and Tissues

6-10 December 2015 | Waikoloa, Hawaii, USA

### Introduction to the conference

After being held in Clearwater, FL and Sitges, Spain, we are pleased to announce that the sixth conference in the series returns to Hawaii. The 6th International Conference on Mechanics of Biomaterials and Tissues (ICMOBT) will take place on 6-10 December 2015 Waikoloa, Hawaii, USA.

Organised every two years, ICMOBT provides a unique international forum for researchers and practicing engineers from different disciplines to interact and exchange their latest results.

### THEMES

1. Biological Materials
2. Biomaterials
3. Bioinspired Materials

### Conference deadlines

Category	Date
Abstract submission deadline	26th June 2015
Abstract review deadline and Program	17th July 2015
Notification to authors	27th July 2015
Author and early bird reg deadline	21st August 2015

Supporting Publications



Organized by



### Keynote Speakers

François Barthelat, Canada  
 Markus Buehler, USA  
 Michelle Dickinson, New Zealand  
 Huajian Gao, USA  
 Qingling Feng, China  
 Lei Jiang, China  
 Kalpana Katti, USA  
 Juan C. Lasheras, USA  
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