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Nature-Inspired Engineering

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Conference Program

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Program

Nature-Inspired Engineering

September 8-13, 2019
Grand Hotel San Michele
Cetraro (Calabria), Italy

Conference Co-Chairs

Marc-Olivier Coppens
University College London, United Kingdom

Bharat Bhushan
Ohio State University, USA



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Sunday, September 8, 2019

14:30 – 17:50	Conference Check-in
17:50 – 18:10	Welcome from the conference chairs and ECI Liaison
18:10 – 19:10	<u>Opening Keynote</u> (Chair: Bharat Bhushan) Nature-inspired chemical engineering, a transformative methodology for innovation Marc-Olivier Coppens, University College London, United Kingdom
19:10 – 21:10	Opening Reception and Dinner

Notes

- Audio, still photo and video recording by any device (e.g., cameras, cell phones, laptops, PDAs, watches) is strictly prohibited during the technical sessions, unless the author and ECI have granted prior permission.
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Monday, September 9, 2019

- 07:30 – 08:30 Breakfast
- 08:30 – 09:30 Session Chair: Mark Cutkosky
Keynote
From plant to product – basic principles, applications and future prospects
Christoph Neinhuis, TU Dresden, Germany
- 09:30 – 10:30 **Keynote**
Nature inspired architecture: Integrative computational design and fabrication for filamentous structures
Achim Menges, University of Stuttgart, Germany
- 10:30 – 11:00 Coffee Break
- 11:00 – 11:40 Session Chair: Yongmei Zheng
(Invited) The biological oxidation inspired biomedical hydrogels
Qigang Wang, Tongji University, China
- 11:40 – 12:00 **Thermal insulation design bioinspired by microstructure study of penguin feather and polar bear hair**
Urszula Stachewicz, AGH University of Science and Technology, Poland
- 12:00 – 12:20 **Nature-inspired, multi-functional surface coatings for space applications, fabricated by additive manufacturing**
Malica Schmidt, University College London, United Kingdom
- 12:20 – 12:40 **Bulk supercrystalline ceramic-organic nanocomposites: New processing routines and insights on the mechanical behavior**
Diletta Giuntini, Hamburg University of Technology (TUHH), Germany
- 12:40 – 13:00 Discussion
- 13:00 – 14:30 Lunch at the Beach
- 14:30 – 15:30 Session Chair: Christoph Neinhuis
Keynote
Bioinspired mechanically durable superliquiphilic/phobic surfaces
Bharat Bhushan, Ohio State University, USA
- 15:30 – 15:50 **Unexpected stability of aqueous dispersions of raspberry-like colloids**
Yang Lan, University College London, United Kingdom
- 15:50 – 16:10 **Structure-property relations of highly ordered bio-nanocomposites**
Suellen Pereira Espindola, Delft University of Technology, Netherlands
- 16:10 – 16:50 Afternoon refreshments
- 16:50 – 18:10 **Rapid-fire oral presentations of posters**
- 18:10 – 19:50 **Poster Session** (with snacks and drinks)
- 20:00 – 21:30 Dinner

Tuesday, September 10, 2019

- 07:30 – 08:30 Breakfast
- 08:30 – 10:30 **Nature inspired solutions Special Interest Group - A UK wide network**
Monika Dunkel, Knowledge Transfer Network, United Kingdom
- Industrial – Academic Discussion: Translation to practice**
Moderated by Monika Dunkel, Knowledge Transfer Network, United Kingdom
- 10:30 – 11:00 Coffee Break
- 11:00 – 13:00 **Workshop: How to use NISE to solve problems in practice?
(A Hands-On Workshop)**
Facilitated by Marc-Olivier Coppens, University College London, United Kingdom
- 13:00 – 18:00 Lunch followed by guided excursion to Diamante and Bevedere**
- 18:00 – 19:45 **Poster Session** (with snacks and drinks)
- 19:45 – 21:15 Dinner

**Information on the excursion can be found after the last page of the program

Wednesday, September 11, 2019

- 07:30 – 08:30 Breakfast
- 08:30 – 09:30 Session Chair: Jacob Thiart
Keynote
Is direct air capture nature-inspired?
Klaus Lackner, Arizona State University, USA
- 09:30 – 09:50 **Nature-inspired flow-fields and water management for PEM fuel cells**
Jason Cho, University College London, United Kingdom
- 09:50 – 10:10 **Electrochemical materials discovery and intelligence**
Kourosh Malek, NRC, Canada
- 10:10 – 10:30 **Nonequilibrium thermodynamics and constructal law guidelines for nature-inspired chemical engineering processes**
Sergio da Cunha, Institut National Polytechnique de Toulouse, France
- 10:30 – 11:00 Coffee Break
- 11:00 – 11:40 Session Chair: Klaus Lackner
(Invited) Discovery, applications and scale-up of bioinspired nanomaterials
Siddharth Patwardhan, University of Sheffield, United Kingdom
- 11:40 – 12:00 **Influence of pulsating flow on dispersion in helically coiled tubes and coiled flow inverters**
Gleb Valitov, University College London, United Kingdom
- 12:00 – 12:20 **Process intensification and process scale-up: Gaps and opportunities**
Jacob Thiart, Exxon Mobil, USA
- 12:20 – 13:00 **(Invited) Bio-Inspired Optics: Liquid lenses imitating eye reflexes**
Natalia Ivanova, Tyumen State University, Russia
- 13:00 – 14:30 Lunch at the Beach
- 14:30 – 15:30 Session Chair: Eugene Goldfield
Keynote
Bioinspired micro/nanostructured surfaces with wettability from design to functions
Yongmei Zheng, Beihang University, China
- 15:30 – 15:50 **Bioinspired materials for water collection, water purification and oil-water separation**
Bharat Bhushan, Ohio State University, USA
- 15:50 – 16:10 **Water-assisted growth of nano-floret hybrid nanostructures and their application in sensing platforms**
Roie Yerushalmi, The Hebrew University of Jerusalem, Israel
- 16:10 – 16:50 Afternoon refreshments
- 16:50 – 17:10 Session Chair: Siddharth Patwardhan
Microfluidic platform for continuous synthesis of nanoparticles
Ondrej Kaspar, University of Chemistry & Technology, Prague, Czech Republic

Wednesday, September 11, 2019 (continued)

- | | |
|---------------|--|
| 17:10 – 17:30 | Balance-of-force selective accumulation of trace ionic species in hierarchical sub-nano-/nano-/micro-porous structures
Andriy Yaroshchuk, ICREA, Spain |
| 17:30 – 17:50 | pH driven colloidal transformation of MS2 virus particles for water purification
Samuel Watts, EMPA, Switzerland |
| 19:00 – 19:30 | Pre-Dinner Social Period |
| 19:30 – 21:30 | Conference Banquet
Poster Prizes |

Thursday, September 12, 2019

- 07:30 – 08:30 Breakfast
- 08:50 – 09:50 Session Chair: Marc-Olivier Coppens
Keynote
Developmental Bioengineering
Eugene Goldfield, Harvard University, USA
- 09:50 – 10:10 **Development of compartmentalized antibacterial systems based on immobilized alliinase**
Viola Tokarova, University of Chemistry and Technology, Czech Republic
- 10:10 – 10:30 **Insect-inspired navigation: Smart tricks from small brains**
Alex Dewar, University of Sussex, United Kingdom
- 10:30 – 11:00 Coffee Break
- 11:00 – 12:00 Session Chair: Bharat Bhushan
Keynote
Nature-inspired robotics for physical interaction with the world
Mark Cutkosky, Stanford University, USA
- 12:45 – 14:30 Lunch at the beach
- 14:30 – 15:50 **Impromptu Session** (discuss a topic that spurred much interest)
- 15:50 – 16:10 Concluding remarks
- 16:10 – 16:50 Afternoon Refreshments
- 16:50 – 19:00 Free time
- 19:00 – 19:30 Pre-dinner social period
- 19:30 – 21:30 Dinner

Friday, September 13, 2019

07:30 – 09:00

Breakfast and Departures

Diamante



On the Mediterranean coast of Calabria, Diamante sparkles like the gem it's named for. It's not certain why it's called Diamante, but the town's history does go back several millennia, first to the Focesi people and then the Romans. It was an important trade point between the Tyrrhenian Sea and the Ionian Sea. Diamante gained status in the Middle Ages when it was under the feudal authority of the Sanseverino family and the prince ordered defenses to be built against possible Saracen invasions. When the threats abated and the powerful Neapolitan Carafa family took the domain, the population started moving to the sea and increased the town's commerce with Naples, Salerno, Amalfi and Sicily.

Fishing and agriculture were the primary occupations, and continue to be the area's important industries, though the beautiful seafront started attracting tourists in search of clean and uncrowded places to enjoy the summer season.

Diamante, the town and the coast, are so attractive that they have been used as the set for several films and TV shows. You'll find a pretty point where the town overlooks the sea on a sort of triangular promontory, with beaches stretching off to the north, and a long seafront promenade to the south. There are a variety of beaches to enjoy, some with sand some with pebbles, interrupted by rocky pieces to form little coves. All told, there are eight kilometers of beach to enjoy here on the coast that is called "The Cedar Riviera".

The town itself has some charming atmosphere and, along with its stone buildings and cobbled lanes, you'll find the many murals that have given Diamante the nickname of "city of murals" - more than 70 in all, painted by prominent artists on the walls of the town's buildings.

A lovely spot right off the coast is the little island called Isola di Cirella. The pretty isle is just 600 meters from the beach, so it can be reached by kayak, pedal boat or swimming, if you're a strong swimmer.

Diamante loves a good party - they several annual events that include the Peperoncino Festa (hot peppers), a Jazz Festival, a Wine Festival and a Film Festival.

Belvedere Marittimo



Located along Calabria's coast, Belvedere Marittimo does have a beautiful view, as its name implies. The historic center sits above the sea in a breezy and panoramic spot overlooking the coastline below. The medieval character of the town, which was established in the 9th and 10th centuries, is maintained and seen in the old gateways and meandering lanes. The city of 9000 enjoys one of the favored swimming spots on the Calabrian coast, where clear water and uncrowded beaches are the area's best kept secret, while tourists tend to flock to Diamante and Scalea to the north.

The old town of Belvedere Marittimo holds several monuments and churches, including the Cappuchin Convent which is dedicated to home-town saint San Daniele, who was born here and martyred in Morocco in 1227. The convent contains the mortal remains of St. Valentine inside the altar. Belvedere Marittimo celebrates the saint with a big festa, earning the town the name of "Citta dell'amore", bringing couples here to declare their love or celebrate their anniversaries every Valentine's Day. The convent's cloister is a lovely space of arcades enclosed within the building, with a water well in the middle.

The Castle with its heavy cylindrical towers was originally built by the Normans in the 11th century but was redone by the Aragons in their preferred style in the 1490s, giving it the distinctive look their Spanish-influenced fortresses are known for. The Torre del Tirone is a 16th century Spanish water tower on the coast, in the modern town of Marina di Belvedere, which was originally a coastal defense structure, then used as a customs house to assess taxes and control the movement of goods in these waters. The "frazione" of Marina di Belvedere is part of Belvedere Marittimo's administration and was developed when the railroad was built in the late 1800s, giving birth to a seaside town. Here you'll find a modern town centered on the waterfront, with beaches backed by the bluff, the old town of Belvedere visible behind it on the hill.

The hills offer natural sculpture formations created by wind and erosion, with hiking trails and beautiful views.

Posters

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Poster Presentations

1. **Kidney-inspired membranes with superior antifouling properties**
Halan Mohamed, University College London, United Kingdom
2. **Synthesis and catalytic properties of hierarchically structured zeolite catalysts with intracrystalline macropores**
Tobias Weissenberger, University College London, United Kingdom
3. **The effects of external surface barriers on diffusion and reaction in zeolite catalysts**
Mohammad Alkhunaizi, University College London, Saudi Aramco, United Kingdom
4. **Trade-offs in Computer-aided Biomimetics**
Ruben Kruiper, Heriot-Watt University, United Kingdom
5. **An evolutionary approach to kinetic modelling inspired by Lamarckian inheritance**
Marco Quaglio, University College London, United Kingdom
6. **Development of biomimetic surfaces with an antibacterial effect based on the structure of dragonfly wings**
Viola Tokárová, University of Chemistry and Technology, Prague, Czech Republic
7. **Microfluidic chemotaxis screening platform for quantification of bacterial viability**
Anand Narayanan Pallipurath Radhakrishnan, University College London, United Kingdom
8. **A nature-inspired passive airflow system for carbon capture and sequestration**
James Niffenegger, Harvard College, USA
9. **A nature inspired approach toward superhydrophobic cotton fabric for multifunctional use**
Poonam Chauhan, Indian Institute of Technology (ISM), Dhanbad, India
10. **Structural change of fluid catalytic cracking catalysts study incorporate with coke characterization formed in heavy oil volatilization/decomposition**
Yeshui Zhang, University College London, United Kingdom
11. **Mussel inspired chemistry and bacterially synthesised polymers for oral mucosal adhesion and drug delivery**
Nazanin Owji, University College London, United Kingdom
12. **A study of solar energy storage using sugar mixture**
Nuttapol Lerkkasemsan, King Mongkut's Institute of Technology Ladkrabang, Thailand
13. **Whale 'blubber' as bio-inspired phase change material**
Özge Güngör, Cukurova University, Turkey