The French-Swedish Prize
For Young Researchers

THE FRENCH-SWEDISH PRIZE

FOR YOUNG RESEARCHERS

Tuesday, November 29th 2011

GREEN CHEMISTRY AND HUMAN HEALTH

1st Prize

JULIEN PELLETIER, Postdoctoral researcher at SLU (Swedish University of Agricultural sciences), Department of Crop Science, Division of Chemical Ecology

Function of olfactory proteins involved in the reception of oviposition signals in mosquito antennae

2nd Prize

IREP GÖZEN, Ph.D. student at Chalmers University of Technology, Department of Chemical and Biological Engineering, Biophysical Chemistry Laboratory

The influence of chemical agents on biological and biomimetic membrane

REDUCING ENVIRONMENTAL FOOTPRINTS IN URBAN LANDSCAPES

1st Prize

SVANTE FISCHER, Postdoctoral student at Uppsala University, Department of Archaeology and Ancient History

Environmental impact of social organisation on urban development in ancient cities.

2nd Prize

HAINING TIAN, Postdoctoral student at the Royal School of Technology (KTH), Department of Chemistry

Sustainable design, synthesis and applications for dye-sensitized solar cell

The French-Swedish Prize
For Young Researchers

GREEN CHEMISTRY SERVING HUMAN HEALTH

FIRST PRIZE

Using mosquito's olfactory system to design new tools for control strategies

Dr Julien Pelletier
Postdoctoral researcher at SLU (Swedish University of Agricultural Sciences),
Department of Crop Science, Division of Chemical Ecology

Julien Pelletier has a Master of Science in Integrated Physiology of Invertebrates from University Pierre et Marie Curie Paris 6. He did his PhD at the laboratory PISC (INRA/Université Pierre et Marie Curie Paris 6) before being a postdoctoral researcher at the University of California-Davis, Department of Entomology. He is currently working at SLU (Swedish University of Agricultural Sciences) in Alnarp, as a post-doctoral researcher. He is working on using mosquito's olfactory system to design new tools for control strategies.

Mosquitoes and other insects rely mainly on their olfactory system to locate hosts, oviposition sites, food sources and mates via specialized sensory units housed on their antennae. In order to design new strategies for vector control, such as the development of attractants and repellents, it is critical to understand how mosquitoes can detect ecologically-relevant olfactory cues. Julien Pelletier is working on a better understanding of the molecular mechanisms of olfaction in mosquito antennae, focusing more specifically on the function of olfactory proteins involved in the reception of oviposition cues in mosquitoes.

In a first step, towards the identification of candidate proteins, Julien Pelletier used the genome sequence of the model, the Southern House Mosquito, Culex quinquefasciatus (Culex), to characterize the genetic diversity within large families of olfactory proteins. He carried out the complete characterization of the odorant-binding protein (OBP) family in Culex by using a combination of bioinformatics and molecular approaches. He demonstrated that a highly abundant antennal OBP, CquiOBP1, is essential for the sensitivity of Culex olfactory system towards specific odorants, including oviposition attractants. Functional characterization of OBPs in non-drosophila insects represents a real challenge. But he showed that RNAi technique can be successfully used to knockdown OBP expression in a mosquito. Using a similar approach, more than 150 odorant receptor (OR) genes in Culex has been identified. It has been found that only a small subset of genes is conserved across mosquito species. Julien Pelletier carried out the de-orphanization of two Culex ORs sharing high identity with orthologs in other mosquitoes, CquiOR2 and CquiOR10, by using the Xenopus oocytes expression system and the empty neuron system of drosophila. He showed that CquiOR2 and CquiOR10 are highly sensitive to oviposition attractants. Interestingly, the response profiles of CquiOR2 and CquiOR10 expressed in heterologous systems resemble those of specific olfactory receptor neurons on Culex antennae, which are natural detectors for oviposition attractants.

These integrated approaches led to a better understanding of how Culex mosquitoes are able to detect ecologically-relevant olfactory cues and provided new insights into the molecular mechanisms of odorant reception in mosquitoes, paving the way for future applications such as the development of new strategies for vector control.

For the French-Swedish Prize for Young Researchers, Julien Pelletier presented two articles:

- "Knockdown of a Mosquito Odorant-Binding Protein Involved in the Sensitive Detection of oviposition Attractants", Journal of Chemical Ecology, Volume 36, Number 3, 245-248. doi:10.1007
- "An Odorant Receptor from the Southern House Mosquito Culex pipiens quinquefasciatus Sensitive to Oviposition Attractants", PLoS ONE 5(4):e10090.doi:10.1371

Julien Pelletier will receive the 1st Prize (50 000 SEK) and a mobility grant to France.

The French-Swedish Prize For Young Researchers

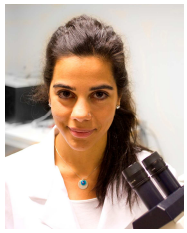
GREEN CHEMISTRY SERVING HUMAN HEALTH

SECOND PRIZE

"Lab in a Droplet": a tool for green chemistry serving human health

Irep Gözen

PhD student at Chalmers University of Technology, Department of Chemical and Biological Engineering, Biophysical Chemistry Laboratory



Irep Gözen has a Bachelor of Science in Molecular Biology and Genetics as well as a Bachelor of Science in Environmental Engineering from Istanbul Technical University (Turkey). She is doing currently her PhD at the Biophysical Chemistry Laboratory, Chalmers University of Technology under the supervision of Professor Owe Orwar.

She is investigating cell membranes, using a "2D Chemical Laboratory in a Droplet". In a micro reaction environment which consists of a functionalized surface, a locally surface-adhered biological membrane of micrometer dimensions and a droplet, ultra small amounts of chemical agents, stimulants and agonists are introduced by pipette microinjection. The "Lab in a Droplet" provides a powerful opportunity to directly study the influence of chemical agents on biological and biomimetic membranes. The structural integrity of the cell membrane has great implications in regenerative medicine. Disruption of biological cell membranes, e.g., of skeletal muscle cells, is common under high mechanical load, and fracture and repair of acute membrane injury are elemental processes of normal cellular physiology. Until recently, surprisingly little was known about the mechanisms of cell membrane injury, as membrane rupture dynamics was studied predominantly in bilayer vesicles, which consistently produced circular pores.

Her experimental work revealed that under the influence of high concentrations of multivalent metal ions, which chemically link lipid molecules to the surface and induce high tension in the membrane, both model and actual cell membranes fracture very much like thin polymer or metal sheets. The study was conducted in close collaboration with Dr. Paul Dommersnes from Laboratoire Matières et Systèmes Complexes (Université Paris Diderot) who provided the theoretical framework to the phenomenon. Irep Gözen's findings not only expand the current understanding of biological membranes, which enables new approaches to cell repair in regenerative medicine, they also connect an established fracture mechanism, which is widely observed in solid state materials, with biological soft matter, opening a new interdisciplinary research field. In her future work, she will focus on the chemistry of fracture formation and investigate the roles of membranes composition, such as cholesterol and membrane proteins.

For the French-Swedish Prize for Young Researchers, Irep Gözen presented the articles:

- "Fractal Avalanche Ruptures in Biological Membranes", Nature Materials, 2010, 9, 908-912.
- "Calcium-Ion Controlled Nanoparticle-Induced Tubulation in Supported Flat Phospholipid Vesicles", Soft Matter, 2011, DOI:10.1039/C1SM05677H.

She will receive the 2nd Prize (15 000 SEK).

The French-Swedish Prize
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REDUCING ENVIRONMENTAL FOOTPRINTS IN URBAN LANDSCAPES

FIRST PRIZE

Environmental impact of social organisation on urban development in ancient cities

Svante Fischer

Postdoctoral researcher at Uppsala University, Department of Archaeology and Ancient History

Svante Fischer defended his doctoral thesis in 2006 at Uppsala University in the department of archeology and ancient history. After his bachelor thesis in history at the University of Brown in the United States, he studied archaeology and medieval history of art in Paris Sorbonne.

His research has focused on the interplay between climate aberrations, water and food supply to urban centers, and the late Roman collapse in Western Europe. In order to enhance a collective understanding of these problems, he organized the international conference "Climate and Coinage - Social and Political Crisis" in 2008, which received funding from VR, the national Swedish Research council. He previously assessed the role of late Roman gold coinage in relation to the question of urban decline in the Western Roman Empire within the Urban Mind project. This research provides vital empirical data while also adding new dimensions to the question of urban resilience in the Mediterranean Basin during the 5th century. The residential cities were supplied with fresh water and comestibles from the outside. Urban areas were in general incapable of supporting their own populations. Some 800,000 people lived in Rome and some 350,000 in Constantinople (Mango 1995, Ward-Perkins 2001). Life in Rome proved to be difficult in the 5th century when compared to the expanding Constantinople. The 5th century urban centres were vulnerable to sudden changes in the equilibrium of military security, fresh water supply, grain import and the real monetary value of commodities.

In the future, he would like to focus on urban centres in western Europe to study the human footprint and the use of water in relation to the urban crisis of the late Roman Period. The trend towards a new form of understanding of the late Roman de-urbanization and inability to sustain cities under the pressure of the human impact on the environment is very clear in current French research. He would very much like to get further involved in this process.

For the French-Swedish Prize for Young Researchers, he presented the following articles:

- Fischer, S; Herschend, F and Victor, H. 2010. The Fall and Decline of the Roman Urban Mind. In Sinclair, P.J.J., Nordquist, G., Herschend, F. & Isendahl, C. (Eds.) *The Urban Mind. Cultural and Environmental Dynamics.* Studies in Global Archaeology 15. Uppsala University. Uppsala.
- Fischer, S; Herschend, F. 2010. The Urban Mind is the Normalcy of Urbanity. In Sinclair, P.J.J., Nordquist, G., Herschend, F. & Isendahl, C. (Eds.) *The Urban Mind. Cultural and Environmental Dynamics.* Studies in Global Archaeology 15. Uppsala University. Uppsala.

He will receive 50 000 SEK and a mobility grant to France.

The French-Swedish Prize For Young Researchers

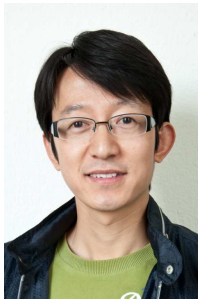
REDUCING ENVIRONMENTAL FOOTPRINTS IN URBAN LANDSCAPES

SECOND PRIZE

Sustainable design, synthesis and applications for dye-sensitized solar cell

Haining Tian

Postdoctoral researcher at the Royal School of Technology (KTH), Department of Chemistry



Haining Tian obtained his doctorate in 2009 at the Dalian University of technology. He received two awards for his work and one of them ranked him among the best 50 chinese students in his field. He worked on design and synthesis of organic dyes for dye-sensitized solar cells. He has currently a position of post-doctorant at the Royal Institute of Technology (KTH) in the department of organic chemistry and works on photosensitizers, redox couples and electrode for dye-sensitized solar cells.

Energy crisis and environment pollution becomes worse and worse due to the limited reserves and excessive consumption of traditional fossil energy. Seeking and using the renewable energies will play a crucial role in protecting our living environment. Solar energy as one of the renewable energies is clean, abundant and widely distributed. Conversing sun light to electricity is an important strategy to utilize the solar energy. The silicon solar cell (Si-SC) is the first successful device that can perform the process above and also the Si-SC has partly joined our life. However, the expensive cost of Si-SC definitely limits its widespread use. Due to the low cost, easy fabrication and high efficiency, dye-sensitized solar cell (DSC) has become more promising since it was invented by O'Regan and Grätzel in 1991. The classic DSC device consists of Ru photosensitizer, iodine-basedelectrolyte and Pt counter electrode. To further decrease the potential pollution and optimize the cost of DSC, he has been working on the alternative materials for this device. So far, he has developed the efficient, less polluted and cheap organic photosensitizer, organic redox couples as well as counter electrodes.

For the French-Swedish Prize for Young Researchers, he presented the following articles:

"Efficient Organic-Dye-Sensitized Solar Cells Based on an Iodine-Free Electrolyte" Angewandte Chemie International Edition Volume 49, Issue 40, 2010, Pages: 7328–7331.

"Organic Redox Couples and Organic Counter Electrode for Efficient Organic Dye-Sensitized Solar Cells" J. Am. Chem. Soc., 2011, 133 (24), pp 9413–9422.

He will receive 15 000 SEK.