

**Innovate & Design**  
Light-Driven  
Microbial Communities



# PHOTO.COMM News

Welcome to the 3rd  
newsletter within the  
Marie Curie ITN  
PHOTO.COMM

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## Since last

Since the last newsletter we have had the fourth training event "From Idea to Business" and have also started planning our final conference "ENCAPP2016: European Networks Conference on Algal and Plant Photosynthesis". Both are described in the following pages.

The fellows have also been quite active in organizing various outreach events. These can all be found on our website <http://photocomm.ku.dk/outreach/>

Some examples are shown in the next pages.

### The Algae Biotech Experience

One of the fellows, Anthony Riseley, has built a website and concept named The Algae Biotech Experience as an outreach activity. The website contains an amazing video about the Private Life of Algae, presented by among others Professor Alison Smith, PI from University of Cambridge. For students The Algae Biotech Experience offers hands on experience in biological science, with a particular emphasis on algae research. See more here: <http://www.algaebiotechexperience.eu/#!/for-parents-and-teachers/ccjp> .



### PHOTO.COMM on twitter.

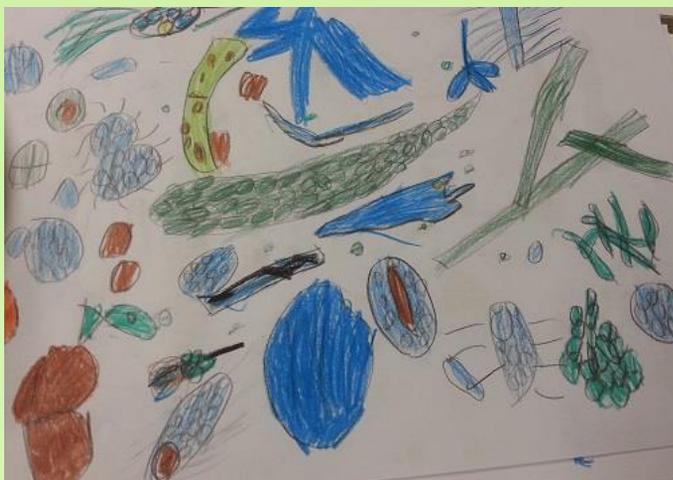
We now have a twitter feed on our website and comments can be found or made under #PhotocommITN

## Outreach activities - examples

### Teaching primary school children about microalgae

Fellow Martina Angeleri taught Italian students from primary school about Microalgae:

*"During my 2h class I first did a short and interactive presentation repeating some of the main features of plant, introducing the concept of photosynthesis and also introducing them to the microalgae i.e. invisible photosynthetic organism. After that, they have been divided in groups that were rotating doing 3 activities: watch microalgae and cyanobacteria picture on a computer, observe microalgae culture by eyes and using a loupe and observe microalgae using a microscope."*



The students also had to draw the microorganisms they had observed, which gave rise to some very nice drawings like this one to the left.

See more: [http://photocomm.ku.dk/news/news-2015/primaryschool\\_microalgae/](http://photocomm.ku.dk/news/news-2015/primaryschool_microalgae/)

## Outreach activities - examples

### Teaching high school kids about microalgae

Fellow Nodumo Zulu invited high school kids to hear about microalgae and get hand on experience with identifying lipids.

Four high school kids from Europaschule Theodor-Heuss-Gymnasium visited the University of Göttingen on the 28th of January, 2015. Here Nodumo first gave a presentation to introduce them to microalgae in general and planned a short practical course for them to identify the lipids in *Phaeodactylum tricorutum*.



The students participated in the following lab techniques:

1. Viewing of microalgal cells under a microscope  
→ to see the two different types of microalgae (green algae and brown algae) that we work with in our lab
2. Staining of the microalgal cells and viewing under a microscope  
→ to view and quantify lipid droplets in the cells
3. Extraction of lipids from microalgae and analyzing them by thin layer chromatography (TLC), viewing of the plates  
→ to recognize different lipids classes in the samples



See more: [http://photocomm.ku.dk/news/news-2015/outreach\\_gottingen/](http://photocomm.ku.dk/news/news-2015/outreach_gottingen/)

## Outreach activities - examples

### STEM conference-Peterborough

Fellow Anthony Riseley has presented how plants, algae and the science have influenced the world we live in to a number of year 11 students at Hampton School.

The STEM conference-Peterborough was organised by the STEMnet foundation and was held in Hampton School. Anthony and a number of other PHOTO.COMM fellows are STEM ambassadors.

Anthony tells about the experience: *"My presentation was on how plants, algae and the science have influenced the world we live in (meteorologically, diversity/complexity of life etc) as well as our human culture. I managed to have a couple of students (and a senior) come up to me after and saying they never knew plants/algae were so influential in the world we live in..."*



See more: [http://photocomm.ku.dk/news/news-2015/stemambassador\\_presentation/](http://photocomm.ku.dk/news/news-2015/stemambassador_presentation/)

## From Idea to Business & Research training on IPR – 4th training event

Since the last newsletter we have had the fourth training event which was held in London 1-3 Sep 2014. It was organized by Dr. Patrik Jones from Imperial College of London. The purpose of this event was to train the fellows, by theory and practical assignments with feedback, in the basic principles and considerations involved in the creation and evaluation of business ideas and proposals.

Before the training event all fellows read the book "The smart entrepreneur: How to build for a successful business" by Clarysse and Kiefer, completed an online multiple-choice quiz based on the book, wrote a business proposal and prepared a business pitch.

The course included among other things

- Presenting business pitch with feedback
- Theory of Creation and Evaluation of ideas, a practical exercise on case studies
- Entrepreneurial market research: Identification of potential market segments. Value chain: understanding the path to the market.
- Intellectual Property. An introduction to protecting your inventions and prospective business.
- Interviews with expert witnesses
- Systematic evaluation of own ideas and preparation of business case under coaching from business school experts
- Defence of business ideas as 'Dragons Den'

See more: [http://photocomm.ku.dk/trainingevents/2014\\_idea\\_to\\_business/](http://photocomm.ku.dk/trainingevents/2014_idea_to_business/)





Group work at the training event 'From Idea to Business'



The winning team in mini Dragon's Den, Gergana, Doris and Witold

## Meet the PIs from University of Cambridge

University of Cambridge (CAM) is one of the top Universities in the world, with the largest research base for biological sciences in the UK. The Department of Plant Sciences has major strengths in molecular biology, biochemistry, epigenetics, development, epidemiology and cell biology, there is a strong core of scientists in the field of bioenergy and industrial biotechnology. The Department of Biochemistry is especially strong in research with investigators of international standing in a wide range of disciplines including structural biology, molecular enzymology, cell signaling and control of gene expression, molecular microbiology, plant molecular biology and bioenergy, cancer and cardiovascular biology.



### PI Prof. Alison Smith

Alison Smith is Professor of Plant Biochemistry in the Department of Plant Sciences at the University of Cambridge. Her research focuses on understanding how plants, algae and microbes make chemicals, particularly vitamins, to be able to exploit the potential of these organisms for biotechnological purposes. She is a founding member of the Algal Biotechnology Consortium, whose interests are the exploitation of microalgae for the production of biofuels and as platforms for industrial biotechnology.

Main supervisor for ESR2, Ulrich Johan Kudahl.



### PI, Prof. Chris Howe

Chris Howe is Professor at Department of Biochemistry. The overall theme of our research is the biochemistry and molecular evolution of photosynthetic organisms. Studies on the photosynthetic machinery led us to discover a novel cytochrome in plants and green algae, now called cytochrome c6A, whose function we are still elucidating. As part of the Algal Biotechnology Consortium, based in Cambridge, we are studying ways of manipulating the photosynthetic machinery of algae for renewable energy production. We are also interested in the chloroplast genome and its evolution. For example,

dinoflagellate algae have a very unusual, fragmented and fast-evolving chloroplast genome. This has the potential to be a valuable genetic marker in studies on coral bleaching, where corals lose their dinoflagellate symbionts. Surprisingly, the closest evolutionary relatives of the dinoflagellates include Plasmodium, the parasite that causes malaria. Although it is not photosynthetic, it retains a remnant chloroplast that is essential for the parasite's survival, and we are studying how this remnant chloroplast might be targeted for malaria treatment. We also have a broader interest in molecular evolution, as well as the application of principles of evolutionary analysis to memes, including sets of manuscripts of texts such as The Canterbury Tales.

Main supervisor for ESR4, Anthony Riseley

## Meet the fellows at University of Cambridge



### **Ulrich Johan Kudahl (ESR2) from Denmark**

Main Supervisor: Prof. Alison Smith (CAM)

Johan started his PhD 1-Aug 2013 with the title  
" *Analysis, design and construction of synthetic  
microalgal communities* "

My research is based on studying communities of  
photosynthetic organisms and bacteria where the  
members of the community exchanges metabolites

such as Vitamin B12 and fixed carbon. I explore the nature of these  
communities using computational tools such comparative genomics to identify  
important genes and metabolic modeling to simulate exchange of  
metabolites between organisms. Using these approaches, I will define a set of  
characteristics for known communities and use this knowledge identify new  
candidate species for photosynthetic communities for renewable production  
of metabolites.

In his spare time Johan's main interests include sailing, road biking and ice  
swimming.



### **Anthony Riseley (ESR4) from New Zealand**

Main Supervisor: Prof. Chris Howe (CAM)

Anthony started his PhD 1-Sep 2013 with the title  
" *Engineering mutualisms in consortia via B12  
dependence* ."

*Mesorhizobium loti* and *Lobomonas rostrata* have a  
natural symbiosis involving the trading of vitamin B12  
and carbon respectively. My first goal is to carry out a

mutagenesis screen on *M. loti* to identify genes involved in excretion of vitamin  
B12 and uptake of carbon. A second goal is to engineer the secretion of  
amino acids from *Anabaena* Sp. PCC 7120 to provide a nitrogen source for *M.  
loti* and *L. rostrata* and receive vitamin B12 in return. I am interested in  
establishing 'proof of concept' consortiums which will aid in providing  
renewable sources of fixed nitrogen for microalgae. In addition to applied  
research, I am also interested in understanding the fundamental genetics of a  
symbiosis between *Lobomonas rostrata* and *Mesorhizobium loti*.

Prior to his PhD Anthony has had a part-time job at university performing circus  
arts and he is also co-founder of New Zealand's youth-led Biotechnology  
communication Organisation – nextGENz ([www.nextgenz.org](http://www.nextgenz.org)).

## Meet the PIs from University of Turku (UTU)

At University of Turku molecular biosciences is an officially recognized strength area, and Molecular Plant Biology is specifically mentioned in this context. The research of Molecular Plant Biology focuses on photosynthesis and environmental stress and adaptation mechanism of photosynthesising organisms such as plant, algae and cyanobacteria. Recently bioenergy has become an increasingly important area of study. Education of the discipline provide students with a strong backbone in both research of photosynthesising organisms and application of research results for practical purposes such as bio-energy sector and plant biotechnology.



### PI Prof. Eva-Mari Aro

Harvesting and transduction of light into chemical energy, with concomitant splitting of water molecules, are unique for oxygenic photosynthetic membranes composed of structurally and functionally highly differentiated membrane protein complexes. Our research from one hand aims at understanding the regulatory pathways that govern the biogenesis, performance and acclimation of the photosynthetic protein complexes in the thylakoid membrane. From the other hand, we also resolve signaling pathways initiated by chloroplast photosynthetic reactions and relayed into the nucleus to regulate the growth and development of plants. Knowledge gained on

photosynthetic reactions is used for applied research aiming at solar fuel production.

Main supervisor for ESR7, Martina Angeleri



### PI, PhD, Docent, Senior Scientist Natalia Battchikova

In order to utilize cyanobacteria for efficient development of a renewable and CO<sub>2</sub>-neutral energy system, it is crucial to achieve comprehensive understanding of energy transfer routes and stress-induced cellular mechanisms, especially of their regulation and signaling. Consequently, it would be possible to envisage appropriate adjustments in fluxes of electrons and nutrients that could be exploited in bioengineering of cyanobacterial strains producing biofuels. We seek and investigate novel proteins and protein complexes that are involved into a versatile network of electron transport flows aiming to expand our knowledge of the

intracellular protein electronic circuit in a cyanobacterial cell. Special attention is paid to interaction and dynamics of electron flows originated from photosynthesis; here, we focus on discovery and analysis of new regulatory pathways based on non-coding RNAs and protein post-translational modifications that are scarcely studied in cyanobacteria.

Co-supervisor for ESR7, Martina Angeleri

## Meet the fellow at University of Turku



### **Martina Angeleri (ESR7) from Italy**

Main Supervisor: Prof. Eva-Mari Aro (UTU)

Martina started her PhD 1-April 2013 with the title  
" Scavenging of "lost" electrons"

The final goal of my study will be to generate a new *Synechocystis* strain with enhanced properties for biofactory application. Robustness and suitability for bioreactors will be improved by scavenging of "lost" electrons to desired chemicals and fuels. Electron transfer can be affected by environmental condition through transcriptional, translational or posttranslational regulation. Taking a closer look I'm studying how reversible phosphorylation is affecting the photosynthetic machinery, as well as effect of non-coding RNA on expression of proteins involved in photosynthesis, using *Synechocystis* 6803 as model cyanobacteria.

In her spare time Martina likes to watch theater and ice-skating shows and listen to Italian music.



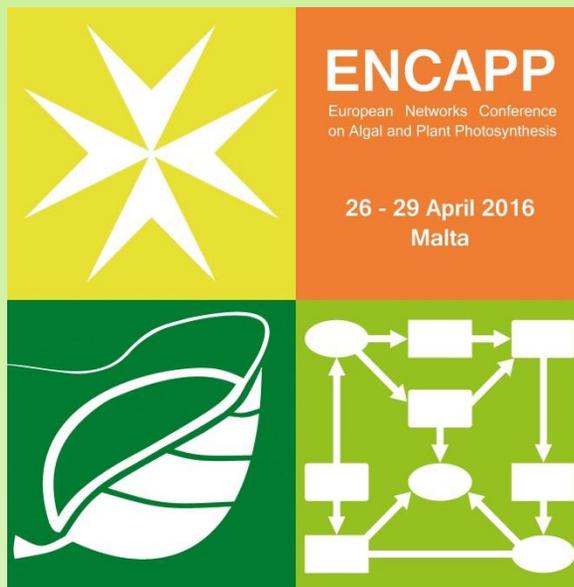
## Our final conference ENCAPP2016, Malta 26-29 April 2016

We have started planning our final conference "ENCAPP2016: European Networks Conference on Algal and Plant Photosynthesis". The conference will be organized in collaboration with the ITN AccliPhot and will take place 26-29 April 2016 in Malta.

Our fellows will be involved in every aspect of the planning and will for instance chair the sessions and the poster session, choose and invite speakers, plan and execute an outreach event etc.

The conference aim to create a platform for knowledge exchange on the topics of:

- Photosynthetic electron flow
- CO<sub>2</sub> & carbon metabolism
- Modelling metabolism
- Light acclimation
- Omics
- Engineering
- Chloroplast structure and assembly
- Communities
- Industrial cultivation



See more here: <http://encapp2016.eu/home/>