

ConGenomics Travel Grant – Scientific report

1. Purpose of the visit

The purpose of this visit was to pursue the collaborative link with Prof Savolainen, leader of a research group with excellent expertise in NGS and bioinformatics. Accessing to training and facilities at the Imperial College was going to provide the necessary skills to step into genomics. During the visit we aim to explore preliminary patterns of divergence among species of Lamnidae, oceanic elasmobranchs that comprehend representatives of the most evolved top predators. At the time of the visit, we had available transcriptomes of some representatives of Lamnidae as well as other shark species, therefore we aimed to explore genome-wide patterns of divergence during speciation of Lamnidae applying Next Generation Sequencing (NGS) technology.

2. Description of the work carried out during the visit

Previous to my visit and thanks to the MRes student Emily Humble (under the supervision of Prof. V. Savolainen at the Imperial College) the muscle transcriptomes for two lamnid sharks *Isurus oxyrinchus* and *Lamna nasus* were completed. In addition, as outgroup, it was sequenced the muscle transcriptome for the sister species *Carcharias taurus*. During the visit, we used RNA-seq data to explore the pattern of divergence among lamnids (endothermic sharks) with the close relative ectothermic shark and characterize those genes that resulted to be under selection.

Endothermy must have evolved under strong selective pressures as maintaining an elevated body temperature is a costly lifestyle as in an aquatic there is a high rate of thermal diffusion making it difficult to retain heat. Furthermore, they sustain high metabolic rates despite the nutrient poor pelagic environment of high seas. However, the proposed selective benefits of endothermy have included enhanced rates of exercise recovery, gonadal growth, central nervous system functioning, digestion and swimming speed, as well as thermal niche expansion into colder water.

3. Description of the main results obtained

We obtained 81,680 *I. oxyrinchus* contigs, 53,103 *L. nasus* contigs and 118,363 *C. taurus* contigs, in which around 30% were functionally annotated. However, despite strong selective pressures to increase aerobic capacity to enable thermal niche expansion, we failed to detect evidence for selection in genes related to metabolism suggesting that endothermy in sharks may be governed by changes in gene expression or membrane modification.

4. Future collaboration with host institution (if applicable)

We are now aiming to expand this work including the recently published heart transcriptome of *Carcharodon carcharias* (the Great White shark) by Richards *et al.* (2013) and have a larger dataset for the lamnid sharks.

Moreover, we are currently sequencing muscle transcriptomes of several species of tunas, fishes

that along with the lamnid sharks have evolved systemic regional endothermy.

5. Projected publications / articles resulting or to result from the grant (ESF must be acknowledged in publications resulting from the grantee's work in relation with the grant)

The resulting articles will include the acknowledgements to the "ConGenomics short visit grant" under the ESF Networking Programmes.

References:

Richards VP, Suzuki H, Stanhope MJ, Shivji MS (2013) Characterization of the heart transcriptome of the white shark (*Carcharodon carcharias*). *BMC Genomics* **14**: 697.

ConGenomics Travel Grant – Expenses*1. Trip: departure on September 1 and return on September 14, 2014*

ferry (resident fare): Venice city – Venice airport (01/09/2014)	EUR 8.00
Flight: Venice – London Heathrow and return (01/09/2014)	EUR 250.23
Bus: Oyster Card London to travel from Heathrow to Feltham and return *	£ 25.00
Train: Feltham – Ascot (01/09/2014)	£ 6.90
Taxi: Ascot train station – Silwood Park, Imperial College (01/09/2014)	£ 6.40
Taxi: Silwood Park, Imperial College – Ascot train station (14/09/2014)	£ 6.00
Train: Ascot – Feltham (14/09/2014)	£ 6.90
ferry (resident fare): Venice airport – Venice city (14/09/2014)	EUR 8.00

* this value includes the £ 5.00 (British pound) as caution and reimbursed after returning the card

2. Living allowance: from September 1 and return on September 14, 2014

As I have left the morning on Sept 1 and returned the night of Sept 14, I had a total of 14 days of meals as air company and lodging were not including any food.	13 breakfast, 14 lunches, 14 dinners
Accommodation at the Imperial College Visitor Lodge, for 13 nights	£ 387.27