

UNDERGRADUATE SUMMER VACATION SCHOLARSHIP AWARDS – FINAL SUMMARY REPORT FORM 2015/16

NB: This report will be posted on the Society's website therefore authors should NOT include sensitive material or data that they do not want disclosed at this time.

Name of student:

Ingrid Lager Gotaas

Name of supervisor(s):

André Toulouse

Project Title: (no more than 220 characters)

Investigation of Morphological and Functional Aspects of Syncytiotrophoblast Nuclear Organization Patterns in the Human Placenta

Project aims: (no more than 700 words)

We aimed to examine normal human placentas to 1) describe the morphological characteristics and structural basis of nuclear organisation patterns in SYT and 2) study the presence and interaction of the SUN-KASH protein family with the SYT cytoskeleton.

Project Outcomes and Experience Gained by the Student (no more than 700 words)**Project outcomes:**

Using immunohistochemistry and laser scanning confocal microscopy, in collaboration with a perinatal pathologist, we compared two placental sampling techniques. First, the usual formalin-fixed embedded tissue blocks were sectioned, prepared and stained and secondly, fine-needle aspiration and cytospin preparations were stained. Our results showed that the fine needle provided samples that are suitable for immunohistochemistry and reduce the preparation steps associated with FFPE blocks. Using a nuclear counterstain, we can easily track the nuclei in our preparations and imaging through confocal microscope allows to track the 3-dimensional structures. We showed that both SUN and KASH family proteins are expressed at the trophoblastic nuclear envelope.

Experience gained:

The laboratory skills I have gained this summer have proved to be invaluable. As I have entered into the final year of my degree our laboratory sessions have become more advanced, and I am definitely more prepared for them than my peers. In addition, 25% of our ECTS credits will be based on a research project. While my topic will not be the same, the research experience gained during the summer has prepared me to tackle any project. Under Dr Toulouse's supervision, I have been exposed to a number of techniques and have come to understand that to properly carry out an experiment, one must also understand the process behind it. I believe that this prepares me for the continuation of my career as I intend to pursue a PhD project after completion of my BSc in UCC. From a technical point of view, I am now familiar with many aspects of immunohistochemistry as well as fluorescence and confocal microscopy.

Please state which Society Winter or Summer Meeting the student is intending to present his/her poster at:

Summer 2017 meeting

Proposed Poster Submission Details (within 12 months of the completion of the project) for an AS Winter/ Summer Meeting – (no more than 300 words)

Preeclampsia and intrauterine growth restriction are two of the most important pregnancy complications worldwide and have been associated with abnormalities in placental trophoblast turnover. Histological evidence shows that syncytiotrophoblast nuclei form specific spatial arrangements and patterns that influence the pathological appearance of some diseased placentas. It is not known whether links exist between these nuclear organisational patterns and how trophoblast cell turnover is organised and controlled.

SUN-KASH proteins are nuclear-envelope bridges responsible for the physical links between nuclei and the cytoskeleton and are required for nuclear organisation in a variety of cells. They are known to play a role in cell turnover and have been implicated in human diseases. These include the laminopathies, some of which affect another syncytium, human skeletal muscle. We propose that the SUN-KASH proteins, through their cytoskeletal interactions, are involved in syncytiotrophoblast nuclear organisation and regulation of their turnover. To examine this hypothesis we established a novel placental sampling method, fine needle aspiration, and compared it to the usual tissue block processing. Using immunohistochemistry to detect the SUN-KASH proteins and confocal laser scanning microscopy (CLSM), we show that this new method allows faster analysis of large numbers of placental villi, reduces the need to scan large areas of tissue and can be rendered in three dimensions using CLSM. Furthermore, we show that the SUN proteins SUN1 and SUN2 as well as the KASH proteins SYNE1 and SYNE2 are expressed at the nuclear envelope of the trophoblastic syncytium.

Brief Resume of your Project's outcomes: (no more than 200-250 words).

The title of your project and a brief 200-250 word description of the proposed/completed project. The description should include sufficient detail to be of general interest to a broad readership including scientists and non-specialists. Please also try to include 1-2 graphical images (minimum 75dpi). NB: Authors should NOT include sensitive material or data that they do not want disclosed at this time.

Investigation of Morphological and Functional Aspects of Syncytiotrophoblast Nuclear Organization Patterns in the Human Placenta.

The human syncytiotrophoblast is the main site of interaction between the maternal uterine matrix and the placenta to provide nutrition to a developing baby. Anomalies in the renewal of the syncytiotrophoblasts have been associated with some of the most common complications of pregnancy, pre-eclampsia and intra-uterine growth restriction. Evidence has previously shown that the nuclei of the syncytiotrophoblast form specific arrangements that influence the appearance of the diseased placenta. Using a novel placenta sampling techniques, fine needle aspiration, we showed that it provides an excellent substrate for fluorescence immunohistochemistry with reduced background compared to the formalin fixation and paraffin embedding method usually used in pathology. Using these techniques, we have established that specific proteins bridging the nucleus of the cells to the skeleton of the cell are present at the nuclear envelope. These results provide us with a strong basis to undertake the study of diseased placenta.

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