Background: The Institute in the Park Laboratories

The laboratories at The institute in the Park, based at Alder Hey Children's Hospital, have specialist facilities for carrying out patient-focussed medical research projects using a comprehensive range of modern technologies. These include microscopy, cell culture, protein analysis, molecular biology and genetics, all essential components of modern research.

The newly built laboratory facility contains both general and specialist equipment areas. Use of the laboratory is open to all Alder Hey Children's Hospital and Liverpool University staff (including many on joint contracts), who carry out patient focussed translational research. The main users of the laboratories are clinical and non-clinical postgraduate research students, clinical research fellows and postdoctoral research staff from the Department of Women's and Children's Health. The mix of scientific and clinically-trained researchers encourages knowledge transfer and interaction between people with very different skills and experience.

How the ThermoFisher System will be used at The Institute in the Park

We have asked for support towards a ThermoFisher Scientific EVOS XL Cell Imaging System plus supporting optical equipment, which will allow coloured or fluorescent light emitted from samples to be measured.

Our work aims to take modern advances in medical science forward into improved patient care. Our work aims to prevent childhood diseases starting and improve diagnosis and treatment of illnesses in children.

<u>The three main research groups currently focus on:</u>

- Juvenile systemic lupus erythematosus (JSLE) and childhood arthritis
- Respiratory disease (chest infection cystic fibrosis and asthma); and
- Childhood leukaemia.

The laboratory does not carry out routine diagnostic tests on patient samples, but much work involves the use of clinical samples in research studies both run locally and as part of national or international collaborations. The ThermoFisher Scientific EVOS XL Cell Imaging System will be used as part of this research work.

<u>Training, storage and security</u>

The new microscopy equipment would be placed within the dedicated microscopy room and open for all research staff to use on a day-to-day basis.

Training will be provided for new staff or those who have not used the system before. The equipment would be looked after by experienced research technicians who ensure laboratory equipment is maintained and used correctly. Cost of maintenance or any repair would be met jointly by the research groups or department. Equipment is normally accessible at anytime but booking is possible for a user who requires extended use in one time period.

<u>Estimated usage</u>

We envisage the microscope being used daily for 2-3 hours as people check culture and evaluate sample quality during experiments.

The equipment will also be used during additional periods where it will be used extensively for full days or weeks as one person or group go through a series of experiments, using the enhanced technology it brings to meet a specific research objective.

Day-to-day benefits

The key, day-to-day benefits of The ThermoFisher Scientific EVOS XL Cell Imaging System range from simply being more user friendly, to enabling the use of new techniques and experimental approaches, thereby facilitating better quality and more effective research. Examples include:

- Use of a screen rather than traditional eye piece. EVOS systems use computer type display screens. This allows us to see exactly what images will be collected and also aids discussion of a result or image removing the need for several users to take it in turns to look down the traditional eye piece. Similarly we can show and discuss results with visitors to the laboratory more easily

- Collecting better quality images for records, publications or presentations. Higher resolution allows a more detailed analysis of each sample. Image analysis system software is more advanced.

- Time lapse allows events such as tissue repair to be followed in real time.

- Flexibility; the equipment can be used for traditional microscope slides and also tissue culture samples.

- Ability to look at light emitted from live cells as well as tissue slides and monitor for the first time real time changes in living cells by light output. This type of experiment has become increasingly common in modern research but is not possible with our current system. It allows tagging of molecules using coloured dyes or proteins. We can then follow if they are active in a living cell or tissue sample by looking for the emitted light.

Long-term benefits

There are many wide-ranging long-term benefits to having ThermoFisher Scientific EVOS XL Cell Imaging System in the Institute, which will greatly enhance our ability to experiment, disseminate findings and attract high-quality research staff:

- Enhanced experimental capacity gained by having the equipment will mean that we can do more types of experiments and can include experiments using this system in our applications for research funding, which were not possible before. This will increase competiveness and opportunity.

- Increased dissemination of findings to wider audiences through higher quality of research results

- The better facilities we have, the better our ability is to attract top quality research staff.

- Ability to remain competitive for national and internal research funding; we need to maintain a modern laboratory with state of the art equipment such as the EVOS system, this includes keeping up to date with new technologies and improvements which allow cutting edge research. This is particularly needed as we develop further our international centre for excellence in research on paediatric diseases.

Patient Impact

The two projects detailed below are currently being undertaken in the Institute, and would be greatly enhanced by the use of the ThermoFisher Scientific EVOS XL Cell Imaging System

Biomarkers in Juvenile Systemic Lupus Erythromatomas (JSLE)

When measured in patient blood or urine, biomarkers allow disease activity or progression to be monitored. The JSLE research group, based in The Institute in the Park, have developed a series of five biomarkers, found in urine, from which they can evaluate the level of ongoing disease in a patient.

These five biomarker could potentially allow clinicians to carry out advance testing on patients to identify whether a disease flare or periods of more intense disease are about to occur.

The biomarkers are currently being tested in a national trial run from the laboratory. If successful, these biomarker will be able to optimise how much drug is needed during any given time to control a patients disease; increasing dose when the disease may be about to 'flare' or become more severe, and decreasing dose when possible to reduce harmful side effects.

These biomarkers are also being evaluated as part of a national trial run from the Institute in the Park, in collaboration with Great Ormond Street Hospital (GOSH) and other UK centres.

> **The ThermoFisher Scientific EVOS XL Cell Imaging System** would enhance the ongoing evaluation of biomarker expressions to:
>
> - Increase understanding of the markers' role in disease, and;
> - Underpin further development in how potential biomarkers can be use in patient care.

Improved drugs for treatment of severe Asthma and Lung Infection. Working with the University of Liverpool's Nanomedicines Group, the Respiratory Research Group is developing new 'smaller' forms of existing drugs which reach the lung more effectively.

The aim of this research is to be able to reduce the patient dose needed to be effective and control disease, but also to reduce harmful side effects. For example, high dose Steroids are used to control severe Asthma, but they can also cause harmful side effects including reduced growth and depression.

Alongside the Nanomedicines Group, the Respiratory Research Group has developed two nanomedicine forms of Steroids, which we hope will better target the disease within Asthma patients and reduce toxicity and side effects to other parts of the body. Further testing is now taking place with Pharmacology Nanomedicines Specialists, to identify whether patients' lungs would respond well to these new forms.

> The enhanced lenses in **The ThermoFisher Scientific EVOS XL Cell Imaging System** would allow us to carry out these tests more cheaply and quickly, greatly enhancing the quality and efficacy of the results for both researchers and patients.

Thank you

We would like to thank the Trustees of The Parry Family Charitable Foundation once again for their continued support of our work at Alder Hey Children's Hospital. We are delighted that the Trustees are considering supporting **The ThermoFisher Scientific EVOS XL Cell Imaging System,** which will make a huge difference to our ability to carry out experimental research that will deliver higher quality results to benefit both patients and researchers.