Medical Electron Microscopy

The electron microscope is a high resolution imaging tool used to reveal subcellular and macromolecular structures in biological tissues and has made a major contribution to our understanding of cell and tissue organization in health and disease. In a clinical setting the electron microscope remains an important diagnostic instrument which is routinely employed in the pathology laboratories of hospitals to investigate a range of biopsy specimens and other tissue samples. Typically the technique is required to aid in the characterisation of disease conditions in kidney tissue and nerve/muscle biopsies as well as in tumour pathology. Other routine applications include investigations of cilia abnormalities in PCD (immotile cilia syndrome) and in public health scenarios and the control of infectious agents including diagnostic virology.

Calcium oxalate kidney stone from 58 yr old male.
The pelvis and calyces of the kidney are common sites for the formation and accumulation of renal stones. More common in men, stones vary in size from >1mm to a large stone that may dilate the entire renal pelvis. Until recently most kidney stones required surgical removal, but ultrasonic disintegration (lithotripsy) and endoscopic removal are often effective alternatives.

SEM respiratory epithelium (Human Trachea)
Patients with the birth defect Primary Ciliary Dyskinesia (also known as Immotile Cilia Syndrome) have defective/absent cilia resulting in mucous retention and a predisposition to respiratory infections and illness. The electron microscope is routinely used to investigate cilia abnormality and abundance, to diagnose and characterise patients with recurrent respiratory illness.

Continuing advances in instrumentation and techniques of specimen preparation ensure that the modern electron microscope remains at the forefront of medical research. The imaging power of the electron microscope allows a greater understanding of the functioning of the human body at the molecular level and the technology is key to the development of nanomedicine and the health care of the future. Several areas of medical care are already benefiting from nanotechnology advances and the use of electron microscope imaging, including targeted drug delivery in cancer therapy; the development of miniature biosensors and subcellular diagnostics; new bio-composites and regenerative medicine.

The series of SSU’s available at the Plymouth EMC are designed to give the trainee clinician/pathologist a greater understanding of the role of the electron microscope as an essential diagnostic tool in the pathology laboratory. There will also be opportunity to assess the impact of electron microscopy techniques on the rapidly developing field of nanomedicine and its implications for healthcare of the future.

Useful website: www.acem.org.uk (association clinical electron microscopists).