DEEPER INSIGHTS THROUGH OPTIMISED TISSUE CLEARING COMBINED WITH HIGH CONTENT IMAGING AND QUANTITATIVE ANALYSIS

Clearing is a valuable starting point for tissue imaging, but to make out fine molecular details, you also need the means to 'zoom in'. Say hello to CELENA-X, the most affordable solution for rapid high content image acquisition and analysis.

Packed full of capability, the CELENA-X is as easy as 1,2,3... rapid imaging and exceptional Z-Stacking allowing depth of focus with the super-fast laser autofocus. Easily set up for an entire 96 well plate, mixing and matching imaging modes and an enviable data analysis package.

The onstage incubator allows users to quickly and easily set up high-content live-cell imaging experiments to measure phenotypes of interest objectively, quantitatively and reproducibly within a precisely controlled environment.

BUT IF IT'S LIVE CELL IMAGING YOU NEED, THEN LIVECYTE CAN PROVIDE DATA NOT AVAILABLE WITH ANY OTHER INSTRUMENT!

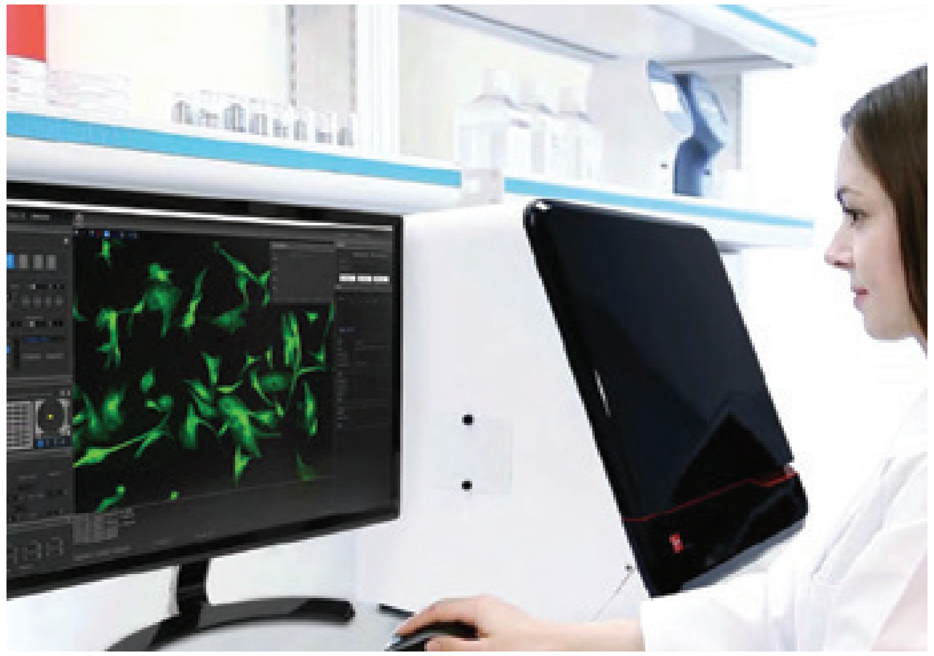
Live-cells can be more troublesome to unlock their secrets. Ideally, live cell imaging needs to identify and track populations and individual cells for prolonged periods maintaining not only life but preserving as much of their natural environment as possible. Fragile cells abhor strong light and perturbing labels common in fluorescence microscopes.

Livecyte provides high contrast images under low levels of light intensity, to preserve natural behaviours. Highly motile cells should be tracked during time-lapse imaging to prevent potentially important cells from being lost or overlooked. Information rich reliable data is key where each experiment automatically yields a plethora of phenotypic parameters such as cell thickness, volume, dry mass in addition to kinetic behaviour characterised by cell speed, displacement and confinement ratio.

Imaging systems should be easy to use, require no calibration, no dedicated consumables and have no hidden costs.

The Phasefocus Livecyte delivers all of this!

X-CLARITY™ Tissue Clearing System.



X-CLARITY™ Tissue Clearing System.

Contact us to discover more:

ATA Scientific Pty Ltd

+61 2 9541 3500

enquiries@atascientific.com.au

www.atascientific.com.au

VECTORLAB AT CHRIS O'BRIEN LIFEHOUSE AUSTRALIA

VectorLAB at Chris O'Brien Lifehouse is a diverse team of specialist scientists and clinicians working to translate advances in science and technology to help people with cancer.

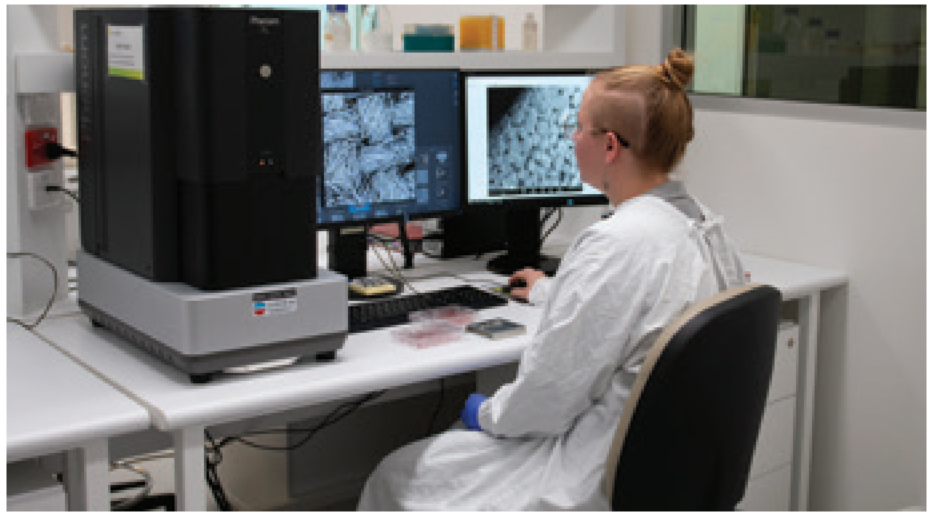
THE TEAM WAS FORMED MORE THAN a decade ago when Prof David McKenzie from The University of Sydney and A/Prof Natalka Suchowerska then from the Royal Prince Alfred Hospital recognised their common interest in bringing the benefits of emerging ideas and technologies to the practice of medicine. This collaboration was originally nurtured by a team of radiation oncologists and has achieved several firsts over the last two decades.

The diverse nature of VectorLAB is a unique asset to Chris O'Brien Lifehouse where leading specialist scientists and clinicians from a range of universities and hospitals are brought together into projects to form the most effective team to address urgent clinical problems.

The dominant health challenge of 2020 has been the COVID-19 Pandemic. VectorLAB is helping to overcome it by developing a new way to reducing microbial and viral activity. They are able to do this work with the help of an NHMRC New Ideas Grant awarded in 2019, when their project was recognised by the Marshal and Warren Award for the most innovative research in 2019. This work, in collaboration with Prof Mark Willcox from the University of New South Wales provides early indications that it will have a role to play in the battle against COVID-19 and also reduce the risk of hospital-acquired infections in general. VectorLAB being at the Hospital-University interface is perfectly positioned to progress such research to benefit the community and especially the patients.

VectorLAB has recently acquired new technology and equipment with the help of philanthropic support and industry awards, which has exciting potential for improving the lives of cancer patients. These include a range of 3D printers for the development of improved implants for bone replacement and a Phenom XL G2 desktop scanning electron microscope (SEM), funded by the Ian Potter Foundation. This microscope is used to scrutinise the surface of 3D printed bone scaffolds to determine whether they are able to support the growth of bone cells. These bone scaffolds will eventually be implanted into a patient's body to replace the bone that was damaged by trauma, deterioration or as a result of cancer surgery.

Fused deposition modelling (FDM) and selective laser sintering (SLS) are common technologies



Phenom XL G2 desktop scanning electron microscope (SEM) at VectorLAB.

VectorLAB group photo, taken on the Lifehouse bridge. From Left to Right: Georgio Katsifis, Prof. David McKenzie, Linda Rogers, Adj. A/Prof. Natalka Suchowerska, Juliette Harley, Hedi Kruse, Adam Rice.

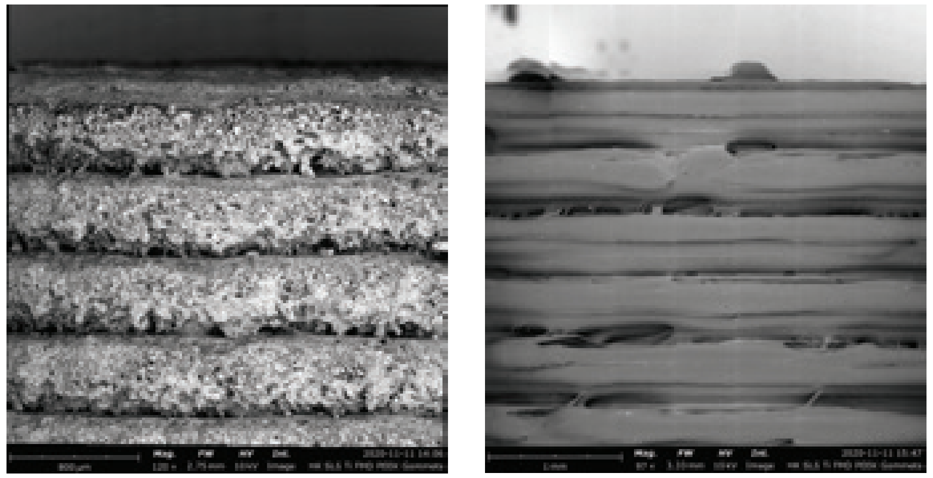


Figure 1: Bone scaffolds made using 3D printing of titanium using SLS (left) and FDM printing of the polymer PEEK (right).

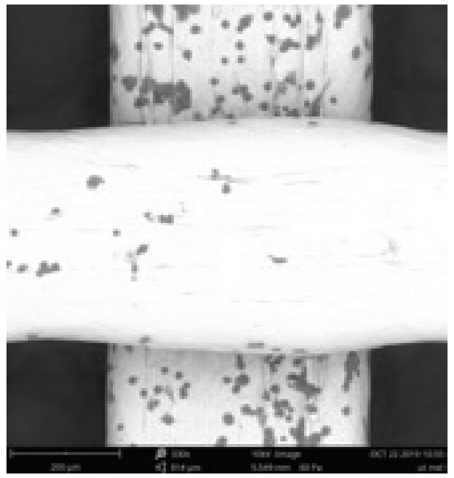


Figure 2: A PEEK bone scaffold using FDM 3D printing, covered with mineralised bone cells.

for 3D printing. In Figure 1 you can see bone scaffolds made using the SLS and the FDM 3D printing techniques. In FDM printing, an object is built layer by layer upwards from a build plate using a heated nozzle fed by a filament that lays a molten strand of material in each layer. In SLS, powerful laser beams fuse powder particles together. The team is working towards the printing of orthopaedic implants from strong, high melting point polymers such as polyether ether ketone (PEEK) and polyether ketone ketone (PEKK). FDM technology has only recently become available for these polymers, which need to be printed at temperatures over 400°C.

To assess the quality of a 3D printed object, good imaging is essential. An electron microscope is still a novelty in a hospital research laboratory such as VectorLAB and as traditionally large instruments, they are usually found in a dedicated microscopy unit. The arrival of powerful electron microscopes that are more like desktop computers means that they are becoming part of the hospital research environment.

In assessing the 3D printed objects, it is not only the surface features that are important, but also the chemical composition of the surface.

To investigate whether the surface chemistry is conducive to bone growth, the researchers use the electrons of the SEM to generate X-rays from the atoms of the object, giving the ratios of chemical elements that make up the surface.

This technique is called energy dispersive spectroscopy of X-rays or EDS. By checking for elements that are favourable in a bone scaffold such as carbon, nitrogen and oxygen, as well as elements that could have adverse effects, such as heavy metals like lead, it's possible to predict whether bone cells will grow.

EDS enables the team to identify potential sources of contamination, like atoms from the nozzle of the 3D printer in FDM, or abrasive particles used to clean up objects after the printing in SLS.

This knowledge informs decisions that can avoid potential problems for patients in the future.

Early evidence shows the bone scaffold concept is working well, with PEEK implants covered with bone cells and their associated bone mineral (Figure 2).

The importance of the SEM examination in interrogating the surface features of an implant has recently been emphasised with the finding that some prosthetic breast implants had surface features that could encourage infections or lead to new cancers.

In figure 3 we show some images at various magnifications of three possible implant materials: titanium metal, PEEK 3D printed with SLS as well as FDM technologies.

The Phenom XL desktop SEM is an important tool that will help VectorLAB understand the implants under development and identify key structural features on their surfaces.

The team is only beginning to unlock its full potential beyond the manufacture of bone implants like assessing the quality of face masks provided during the COVID-19 pandemic or better understanding the unique features of cancer cells.

VectorLAB's research supports the vision of Chris O'Brien Lifehouse to transform cancer treatment through discovery and innovation and position Australia to make a significant contribution to global health beyond cancer care.

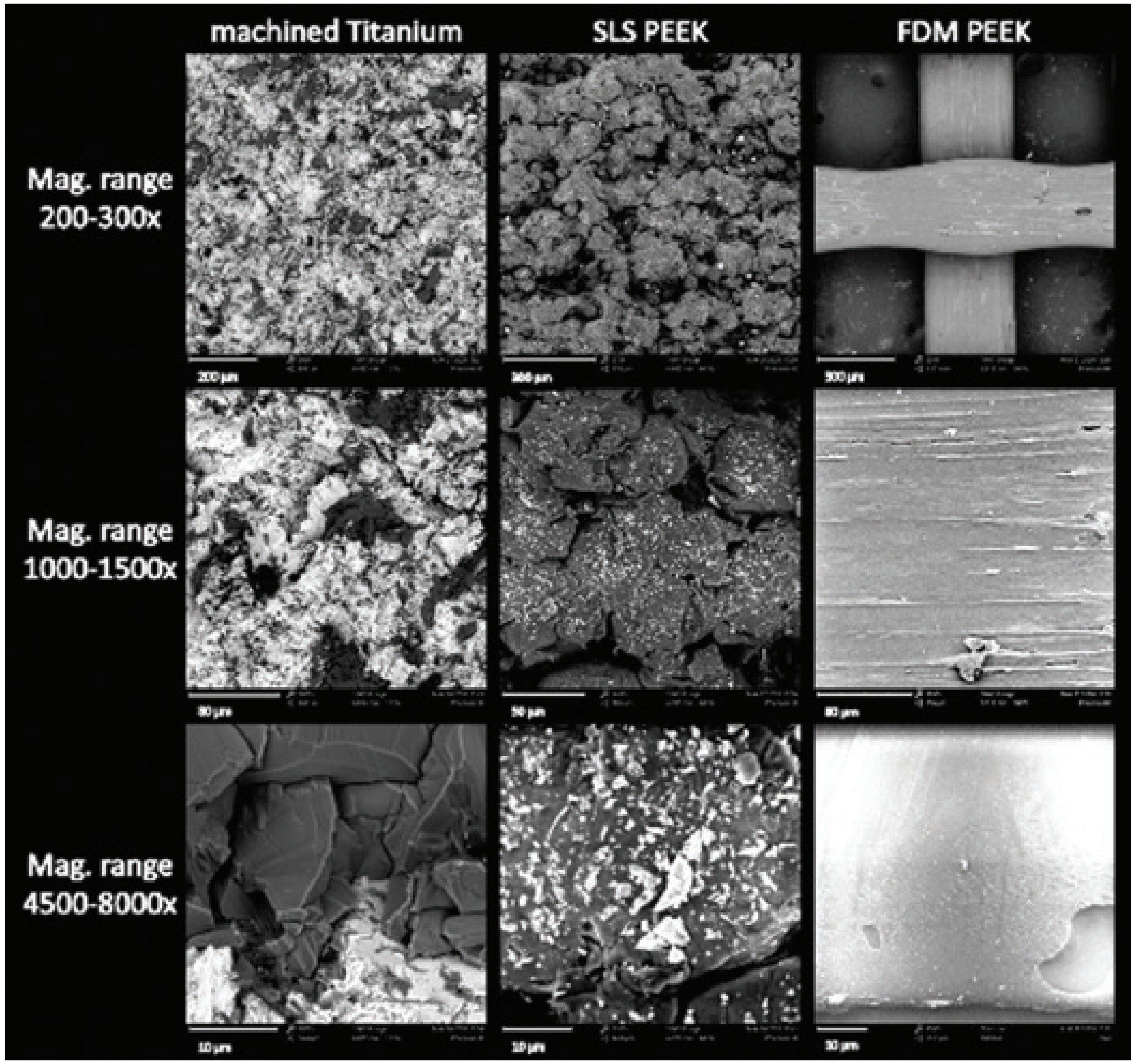


Figure 3: Visual summary of three possible bone implant materials. From the left, these are machined titanium, SLS printed PEEK and FDM printed PEEK. Note the difference in surface roughness which may affect the way the patient's bone cells will react to the surface.

For more information about VectorLAB contact

A/Prof. Natalka Suchowerska
Director of VectorLAB, Chris O'Brien Lifehouse
+61 2 85140324
natalka.suchowerska@lh.org.au

For Phenom SEM enquiries contact

ATA Scientific Pty Ltd
+61 2 9541 3500
enquiries@atascientific.com.au
www.atascientific.com.au