PRESS RELEASE

CHRIS O'BRIEN LIFEHOUSE STRENGTHENS CANCER FIGHTING RESEARCH WITH THEIR NEW PHENOM XL G2 DESKTOP SEM

WE'RE PLEASED TO ANNOUNCE THAT THE new second-generation Phenom XL Desktop Scanning Electron Microscope (SEM) is installed in VectorLAB at Chris O'Brien Lifehouse (COBL). The Phenom XL desktop SEM is being used to unlock key insights and facilitate the rapid, high-resolution analysis of microstructures of 3D printed biomaterials, to shorten the path between discovery and new cancer treatments.

Phenom XL arrival at COBL and training at ATA Scientific.

VECTORLAB AT CHRIS O'BRIEN LIFEHOUSE

Formed over a decade ago by A/Prof Natalka Suchowerska and Professor David McKenzie, VectorLAB is a collaborative research space that brings together scientists from Chris O'Brien Lifehouse comprehensive cancer hospital and The University of Sydney School of Physics to solve some of the most urgent problems in cancer.

Researchers from the disciplines of medicine, physics, biology and chemistry work together to translate advances in science and technology to the practice of medicine.

Chris O'Brien Lifehouse is the largest cancer clinical trial centre in New South Wales, giving cancer patients access to some of the world's newest lifesaving drugs and breakthroughs.

Research and trials are carried out by the same clinicians who treat patients, shortening the path between discovery and new treatments.

RESEARCH AT VECTORLAB

VectorLAB is engaged in a broad range of research projects, with the common focus of translating emerging technologies and understanding in science to medicine for the benefit of the patient.

Typically, when cancer patients require surgery that involves removal of sections of bone to treat their cancer, the bone will be replaced either with bone from another part of the body or a titanium implant.

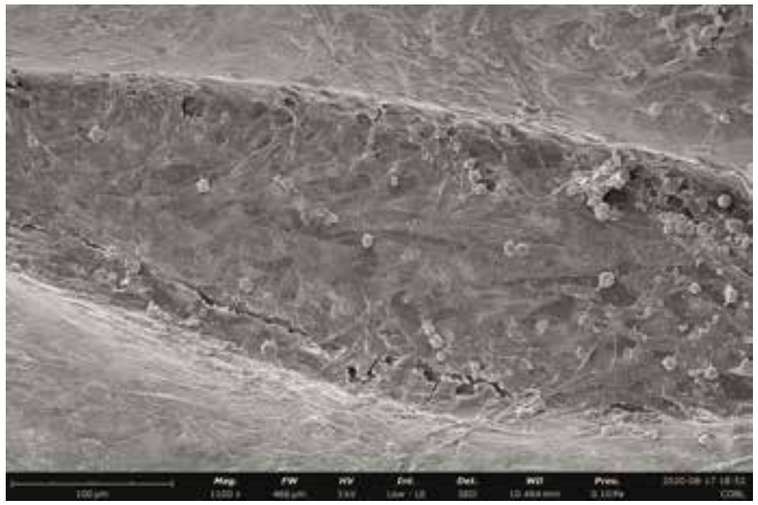
The VectorLAB team is working on an exciting project to find a way to use 3D printed polymer implants that when implanted into the body, integrate with the patient's bone.

The Phenom XL is being used extensively and is facilitating the development of high-performance polymer implants.

By meeting the need for high-speed and high-resolution imaging in addition to versatility and ease of use, the Phenom XL allows SEM analysis to be brought inhouse, shortening development cycles.

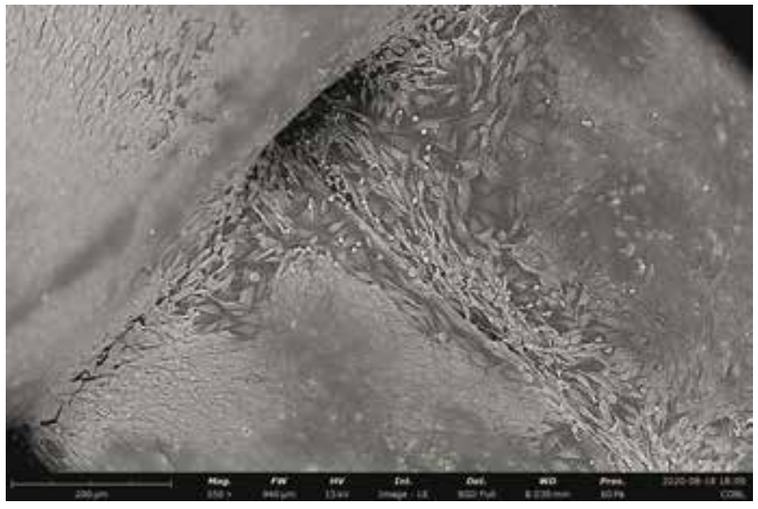
Rapid, high quality images of 3D printed polymer implants generated using the Phenom XL will help expedite research and development of new implants that are custom built and optimised for individual patients.

> **"When patient implants fail, we sometimes don't know why. The images provided by the Phenom will enable us to build bone replacement implants that fit the patient needs better and last longer**



Secondary electron image of gold coated bone cells on the scaffold showing the surface detail.

Wide field view examining the overall structure of the 3D printed scaffold. Image taken using the Phenom XL G2 desktop SEM.



Low vacuum backscatter image of osteoblasts [bone cells] growing on the surface of the 3D printed scaffold. Images taken using the Phenom XL G2 desktop SEM.

Future projects in store for the Phenom XL SEM include:

- Imaging of surface features and fine structures of 3D printed objects, mainly orthopaedic implants
- Analysis of surface properties such as porosity and roughness of 3D printed implants
- Identification of contamination of 3D printing materials and other biomaterials
- Imaging of interaction of human cells with 3D printed implants, specifically cell adhesion, spreading, colonisation and mineralisation, indicating differentiation of the cells
- Quantification of cell mineralisation on the implant

Customer's perspective

"The intuitive and simple yet sophisticated user interface makes the Phenom a pleasure to use"

We first encountered the Phenom Scanning Electron Microscope at The University of Sydney where it is used for engineering applications. We found the compactness as a desktop unit and the operation speed of the Phenom XL made it a good tool to answer our questions in the medical research environment. The high-resolution images enabled us to visualise our biological samples without special sample preparation, providing evidence on how to give patients the best implant outcomes.

"The Phenom provides answers to questions that were holding us back"

Our experience with the system has been positive. The intuitive and simple yet sophisticated user interface has convinced us that we will make use of the Phenom beyond the immediate project. The Phenom XL provides a large sample stage [10 cm2], which enables us to analyse large samples as well as side by side analysis of replicates in biological experiments.

"Effortless SEM analysis to do more research"

Mineralisation is the process by which pre-osteoblastic cells become solid bone. With the Phenom, we can now easily identify mineralised regions on our 3D printed implants and quantify their atomic composition by Energy Dispersive X-Ray (EDX) Analysis. We can essentially follow the cells' colonisation of the 3D printed structures and identify surface features that benefit the cells' mineralisation behaviour. We find this approach to be more sensitive than chemical methods traditionally used to quantify mineralisation.

UNIQUE FEATURES OF THE NEW PHENOM XL G2 DESKTOP SEM

The next generation Thermo Scientific Phenom XL G2 Desktop SEM is a robust, versatile, and effortless desktop scanning electron microscope designed to expand the capabilities of research facilities.

Its ease-of-use, rapid sample preparation and handling produce unparalleled time to data.

Users can obtain high-quality images in just 40 seconds—three times faster than other desktop SEM systems.

Phenom XL offers an improved resolution of 10 nanometres, enabling even more resolving power and the ability to explore large samples of up to 100 by 100 millimetres.

When compared to the more common tungsten filament electron sources, its Cerium hexaboride (CeB6) electron source is longer lasting with higher brightness.

In addition to fast, high-resolution imaging, the Phenom XL G2 has an integrated energy dispersive X-ray (EDS) detector for elemental analysis. A simple click on the spot of interest will provide a list of elements present using live energy-dispersive X-ray (EDS) analysis.

The all-new 24-inch diagonal user interface combines what were once separate screens for images and analyses into a single full-screen image providing faster and convenient access to information needed.

The Phenom XL G2 is an intuitive desktop SEM that requires little training and no expert oversight, making it the perfect solution for research groups that want to extend electron microscopy to a greater number of staff and students.

VectorLAB at Chris O'Brien Lifehouse formally acknowledges the following collaborators and funding groups that assisted to make this possible.

- Australian Government – Funding for the Sarcoma Surgical Research Centre and for the construction of the new VectorLAB PC2 Laboratory at Chris O'Brien Lifehouse.
- The Ian Potter Foundation – Funding for the Phenom XL.

Note: The Phenom XL SEM is currently in use at Chris O'Brien Lifehouse and will be moved to the new expanded laboratory space upon completion which has been slightly delayed due to the current flux of COVID-19 government restrictions imposed. Be sure to read our article in the next issue where we will include a follow-up and some exciting new developments.

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PRESS RELEASE

JOURNEY THROUGH THE BRAIN – MAKE OPAQUE TISSUE TRANSPARENT WITH X-CLARITY

"SEEING IS BELIEVING" IS A COMMON rule of thumb for many fields and is the most commonly utilised method for studying, proving, and "believing" experimental results. It's particularly useful when studying brain tissue as imaging helps us understand the connectivity and dynamics of neuronal networks and brings us closer to system-level understanding of physiology and disease in complex mammalian systems.

However, the complexity of brain tissue and natural opaqueness can reduce image resolution. A variety of molecules such as water, lipids, and proteins interact with light causing it to scatter, limiting the amount of light transmitted essential for microscopy.

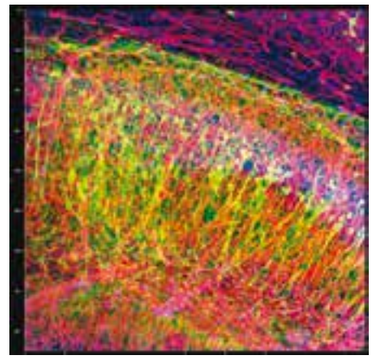
One way to improve resolution, is to reduce the scattering by removing water and lipids from tissue. Early tissue clearing methods employed organic solvents to clear large organs, several of which were highly toxic and damaged delicate neural tissues through shrinkage and dehydration, which quenched most fluorescent proteins.

The growing need for high resolution 3D imaging of larger, thicker samples without sectioning has led to the development of the X-CLARITY advanced tissue clearing method.

The difference is clear with X-CLARITY™ systems and reagents

The X-CLARITY is an all-in-one system that optimises the tissue clearing process. It transforms intact biological tissues into a nanoporous hydrogel-tissue hybrid, preserving anatomical structures, proteins and nucleic acids in preparation for high-resolution intact tissue imaging.

Secondary electron image of gold coated bone cells on the scaffold showing the surface detail.



Ultrafast clearing made simple to accelerate whole tissue 3D imaging. X-CLARITY allows users to clear a whole mouse brain in just 6 hours while also maintaining endogenous fluorescent protein signals. Thy-1-YFP mouse brain cleared with X-CLARITY, labelled with anti-Collagen IV and TO-PRO-3. Long-term preservation of the Thy1-YFP signal in tissues cleared with the X-CLARITY™ systems and reagents is made possible.

The X-CLARITY™ system with ready-to-use reagents offers simple, rapid and reproducible tissue clearing that is aqueous based. Building on the CLARITY (Clear Lipid-exchanged Acrylamide-hybridized Rigid