



Cutting-edge research
in stem cell therapy

ADSCC
MEDICAL EQUIPMENT
CATALOGUE

ADSCC

مركز أبو ظبي للخلايا الجذعية
ABU DHABI STEM CELLS CENTER



Delivering cutting-edge research and regional firsts in stem cell therapy.

The center was founded in March 2019 to meet growing domestic and regional demand for advanced medical services and treatments in the UAE.



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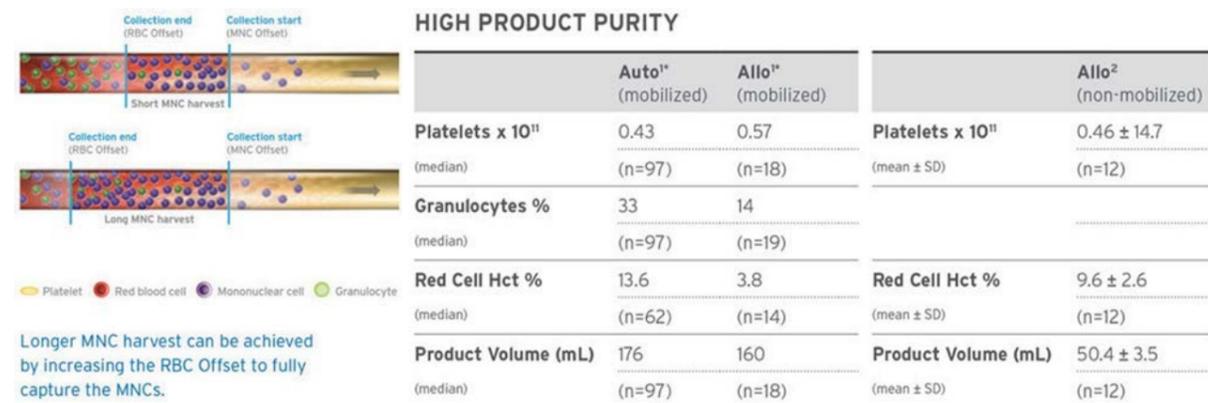
1 MONONUCLEAR CELL COLLECTION AMICUS SEPARATOR

Therapeutic apheresis and cell collection

The Amicus Separator automated system consistently performs mononuclear cell collection (MNC) with high yields and low patient platelet loss. Flexible controls allow tailoring of MNC settings for target cell content based upon clinical need. Automated custom prime for lower blood volume and lower hematocrit patients. Low extracorporeal volume (163 ml).

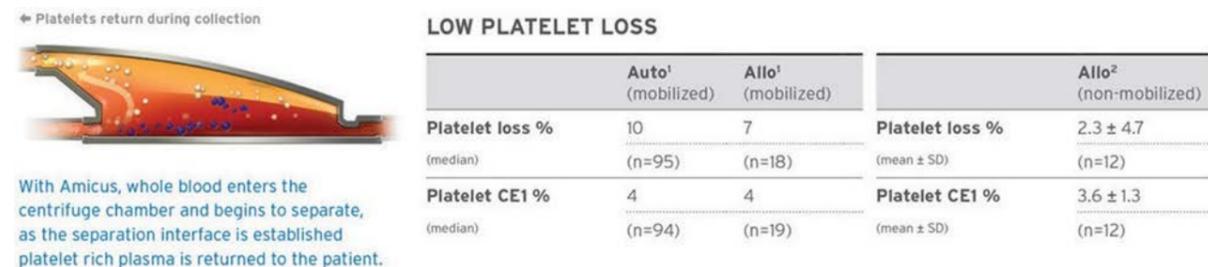
Tailor collections

Every MNC collection is different because every patient and donor is different. Amicus is designed to make it easy to tailor collections for high product purity and high MNC yield.



Spare platelets

One therapeutic procedure shouldn't result in the need for another one. Amicus keeps median platelet loss at 10%, so you can perform MNC procedures on patients and donors with reduced need of associated platelet transfusion.



Support patient comfort

Comfort is a key part of the care you provide. With low extracorporeal volume (ECV) and low-noise operation, Amicus delivers a gentle experience, even for delicate patients and donors.

Extracorporeal photopheresis (ECP)

Extracorporeal photopheresis (ECP) is a cell-based immunomodulatory therapy that involves collecting leukocytes from peripheral blood. These cells are exposed to a photosensitizing agent, 8-methoxypsoralen, and are then treated with ultraviolet (UV) radiation, after which they are re-infused. This procedure, which results in crosslinking of pyrimidine bases in DNA, produces massive apoptosis of the treated cells. The procedure was developed in 1987 by Dr. Richard Edelson for use in treating cutaneous T-cell lymphoma.

The mechanism of action of ECP has been extensively explored, and several theories have been advanced:

- Clearance of apoptotic cells by antigen-presenting cells results in differentiation of those cells into a more tolerogenic phenotype, leading to decreased stimulation of effector T cells or their deletion.
- Production of anti-inflammatory cytokines, especially interleukin 10, is increased.
- Production of pro-inflammatory cytokines, especially interleukin 12 and TNF α , is decreased.
- Generation of CD4+, CD25+, GITR+, Foxp3+, CD62L+ T-regulatory cells occurs.



Clinical applications of ECP

- Cutaneous T-cell Lymphoma
- GVHD following bone marrow or stem cell transplant
- The rejection of solid organ transplant
- Autoimmune diseases where cell-mediated mechanisms are dominant

ECP Procedure

- Amicus Separator
- ECP Apheresis Kit
- Phelix Photoactivation Device

The procedure is similar to the conventional aphaeresis. Fresenius Kabi PlaGorm include an aphaeresis kit and the Photoactivation Device (Phelix). This plaGorm can perform both, conventional therapeutic aphaeresis and ECP protocols. Amicus separator provide a real time monitoring during the whole procedure.

2

FLUIDIGM HELIOS MASS CYTOMETER AND HYPERION IMAGING SYSTEM

Fluidigm Helios Mass Cytometer



Mass cytometry, also called cytometry by time-of-flight, is an emerging powerful single-cell proteomic analysis technique which utilizes rare metal isotopes instead of fluorophores for antibodies labeling to break the limit of multiplexing capability of FACS. Mass cytometry is the world's most advanced single-cell proteomics technology.

The Fluidigm Helios Mass Cytometer system provides a robust, reproducible, reliable way to measure over 50 biological parameters in one sample, dramatically increasing the amount of information produced and yielding new insights into systems biology.

Cellular targets in liquid suspension can be labeled with more than 40 metal-tagged reagents, including antibodies, nucleic acid intercalators and analogs, and biochemical ligands.

Each reagent is detected and quantified with cytometry by time-of-flight mass spectrometry in the CyTOF system. Targets can be anywhere in the cell, including the surface, cytoplasm, nucleus or internal organelles.

BENEFITS

- Provides high-parametric data on individual cells prepared in liquid suspension. Sample size can vary from thousands to millions of cells.
- Complete profiling allows CyTOF researchers to investigate a range of applications, including phenotyping, functional activity, apoptosis and cell cycle analysis.
- Phosphoprotein detection can be used to map the signaling profile of samples, and optimized protocols and detailed technical assistance are available for any combination of targets.
- Allows barcoding of reagents to allow unique metal-ion tagging of up to 20 individual liquid suspension samples - offering increased throughput, improved protocol consistency and enhanced data quality.

Hyperion Imaging System

The Hyperion is an "attachment" that links to the Helios to create an Imaging Mass Cytometry (IMC) system, which allows the visualization of proteins, biomarkers, and their subcellular expression in specific context to the tissue microenvironment. At single-cell resolution, it provides insights into the spatial relationships of molecules that direct cell signalling pathways and phenotypes.

The Hyperion also provides in-depth characterization of protein biomarkers, cellular composition and interactions. Investigating the expression of biomarkers in the context of disease can aid the development of diagnostics and effective therapies. It uses the same basic principle of labeling with metal-tagged antibodies to detect specific proteins within a 2D matrix.



BENEFITS

- Provides single cell resolution to accurately quantify and assess phenotypes and cell function.
- Interrogates 4 to 37 protein markers at subcellular resolution simultaneously in one scan, saving precious sample.
- Employs precise laser beam pulses on biological samples stained with Maxpar metal-tagged antibodies.
- Metal-tagged antibodies are detected and quantified based on mass, eliminating autofluorescence and high background noise.
- Equipped with 135 channels to detect additional parameters.
- Allows working with heterogeneous biology.
- Includes the CyTOF software for imaging and cell suspension-based sample analysis.



APPLICATIONS

Superior single-cell analysis of hematopoiesis and the immune system for characterization of disease and transplantations

Stem Cells

Defining stem cell populations while also examining multiple signaling pathways and molecules simultaneously, which allows to predict with greater certainty the effectiveness of therapy and discover new fields of applications.

Hematopoietic Stem Cells Transplantation (HSCT)

Chronic graft-versus-host disease (cGVHD) is a debilitating complication arising in around half of all patients treated with an allogeneic HSCT and it remains one of the main causes of morbidity and mortality in affected patients. Mass cytometry could identify unique subpopulations specific of activated B cells in patients with cGVHD that can serve as diagnostic marker and as therapeutic targets.

Reconstitution of a healthy donor-derived immune system after HSCT involves the coordinated regeneration of innate and adaptive immune cell subsets in the recipient. Mass cytometry presents a superior tool to define immune reconstitution post-HSCT from a systems-level perspective, by allowing the phenotypic and functional features of multiple cell populations to be assessed simultaneously. A higher-diversity index based on single-cell combinatorial phenotypes in mass cytometry is also a marker associated with a lower risk for relapse after HSCT.

Cancer Research

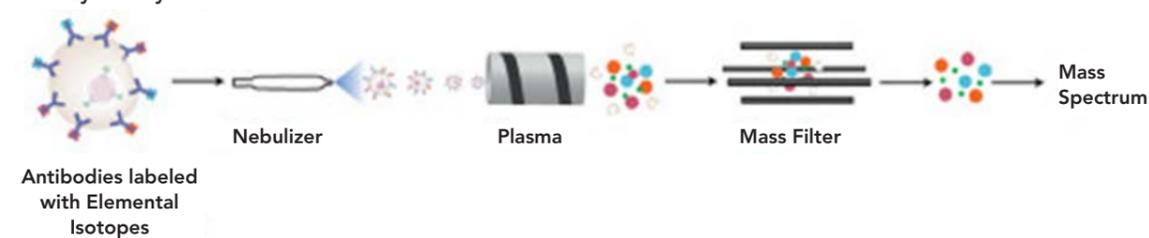
Detect uncovered leukemia cell populations present in patients that correlated with future disease progression.

Immunology

Characterization of all immune system cell-populations related to health, disease, stem cell therapy and provide a goal information of the decline of immune system in aging.

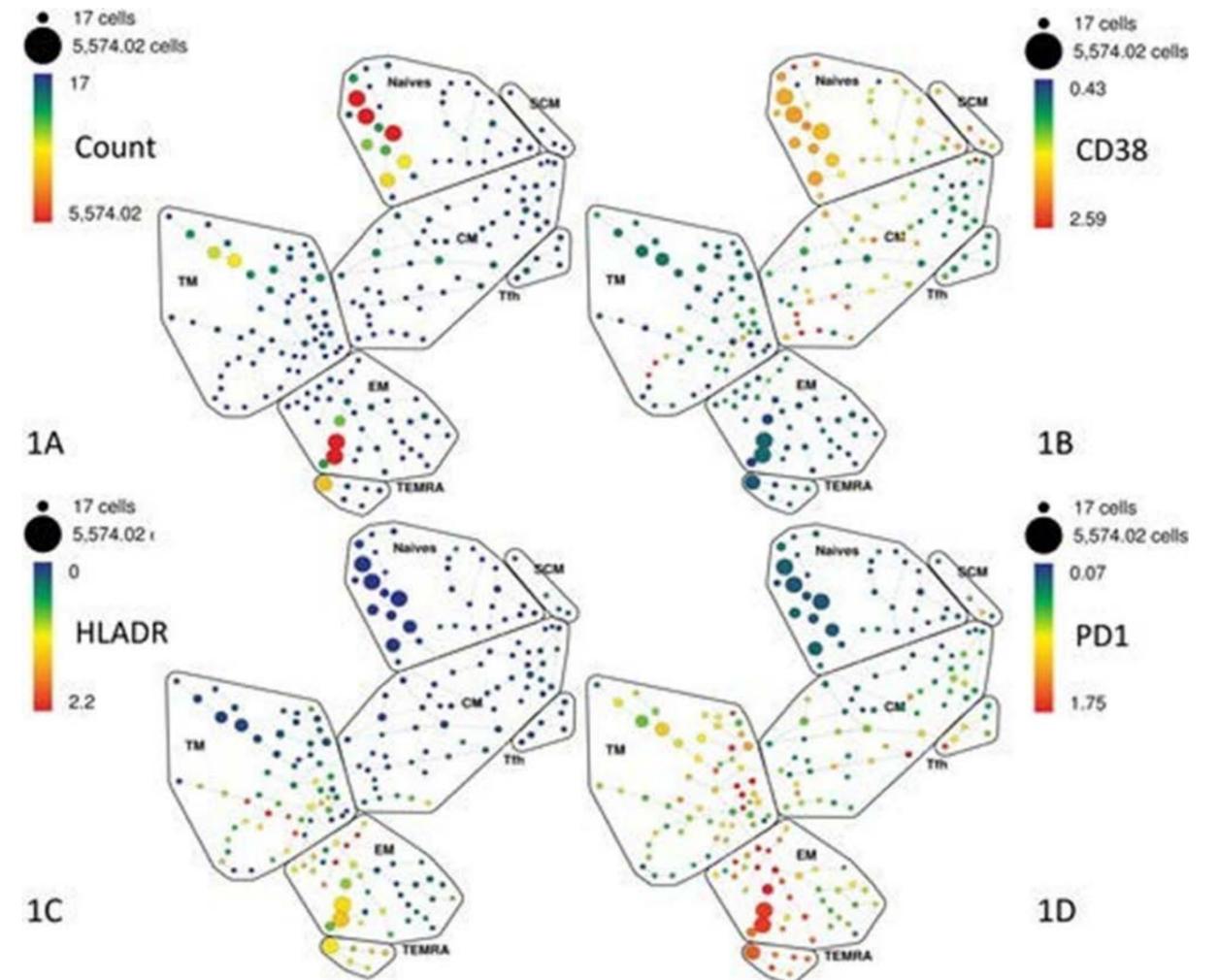
Number of parameters to be studied: **70**, Immune profiling assay: **30**, Cell cycle: **5**, Leukemia blood cells: **15**, Hematopoietic stem cells: **7**, Pluripotent stem cells characterization: **13**

Mass Cytometry

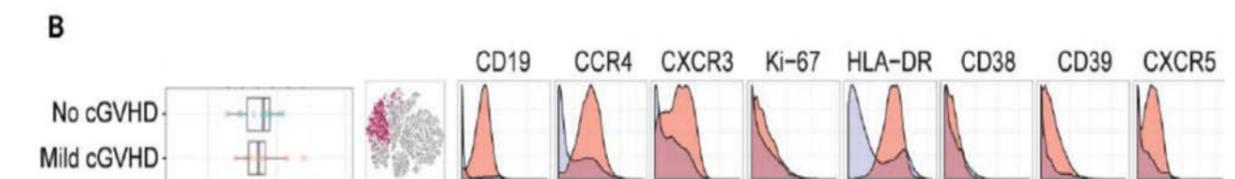
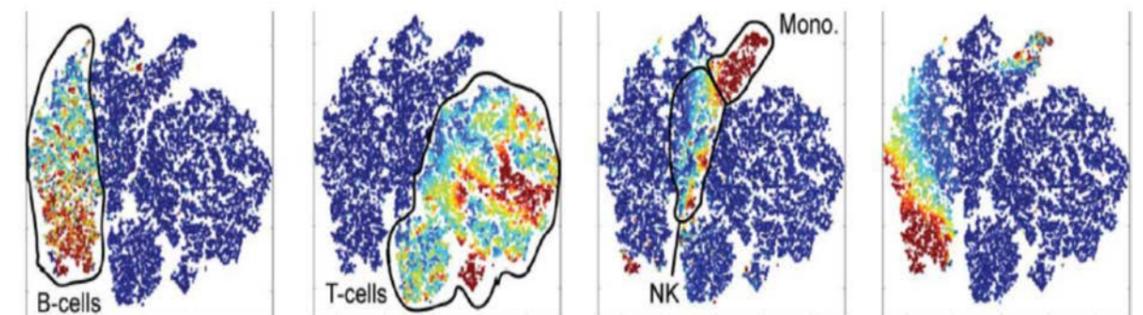


Mass cytometry: Cells are stained with antibodies conjugated to metal isotope reporters with different masses. Then cells divided into single-cell droplets are nebulized and analyzed by mass spectrometry.

Source: <https://www.sciencedirect.com/topics/medicine-and-dentistry/mass-cytometry>



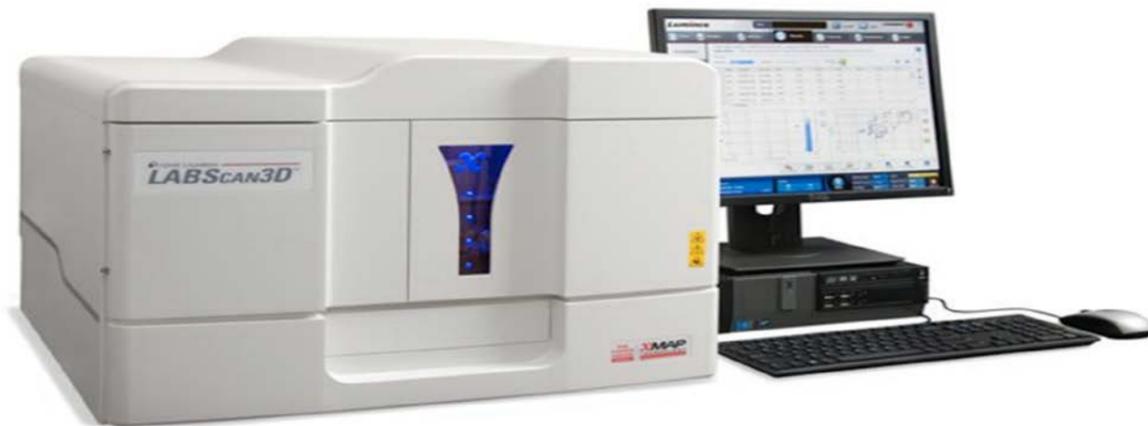
Distribution of subsets and key markers in the peripheral blood CD4 compartment. SPADE from a representative HIV+ untreated donor representing: (A) cell counts, (B) CD38 cell expression, (C) HLA-DR cell expression, and (D) PD-1 cell expression. Source: <https://onlinelibrary.wiley.com/doi/full/10.1002/cyto.b.21502>



Mass cytometry analysis in patients without chronic graft-versus-host disease (cGVHD) versus patients with mild cGVHD. B: B-cell subsets expressed CD19, HLA-DR, CD39, CXCR5, CCR4, and CXCR3.

Source: Stikvoort et al. Front. Immunol. 8:717. DOI: 10.3389/fimmu.2017.00717

3 ONE LAMBDA LUMINEX LABSCAN 3D



Human leukocyte antigen (HLA) typing is used to match patients and donors for bone marrow or cord blood transplants. HLA are proteins -- or markers -- found on most cells in the body. Our immune system uses these markers to recognize which cells belong in your body and which do not.

- LabScan 3D Luminex system has dual syringe pumps and reagent reservoirs that allow for higher throughput and planned maintenance routines.
- With its ability to process 500 bead regions simultaneously, there is significant increase in the size of screenable analytes.
- 500 beads can simultaneously be multiplexed in a single sample.
- HLA typing and detection of HLA antibodies
- Auto-antibody detection
- Blood Genotyping
- Cross Match Testing
- Characterization of blood for cryopreservation
- Number of parameters: **10**

BENEFITS

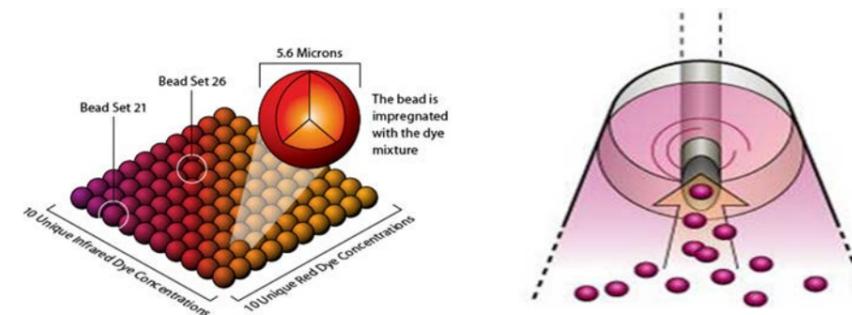
- Ability to process 96 samples with state of the art optics, electronics, and software.
- The LABScan3D system is based on Luminex® xMAP® technology and uses Luminex® xPONENT® software for data acquisition.
- The end user can make assignments of HLA antibodies as well as HLA typing with the analysis support of HLA Fusion.

APPLICATIONS

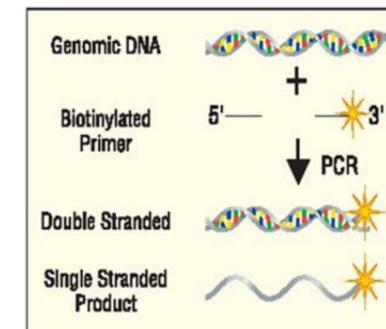
Hematopoietic Stem Cells Transplantation (HSCT)

Allogeneic hematopoietic stem cell transplantation (allo-HSCT) is an effective treatment for patients with hematological malignancies. The degree of HLA identity that can affect the outcomes of allo-HSCT, anti-HLA antibodies, especially donor-specific anti-HLA antibodies (DSHAs), have been shown to have a negative prognostic impact on patients who undergo allogeneic stem cell transplantation. Possessing anti-HLA antibodies has a negative effect on engraftment and contributes to a lower overall survival rate and higher graft failure.

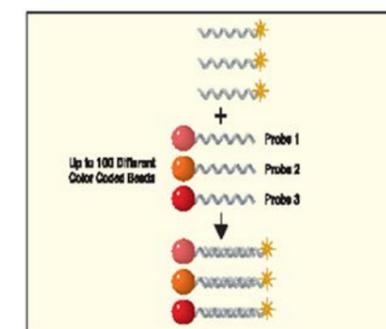
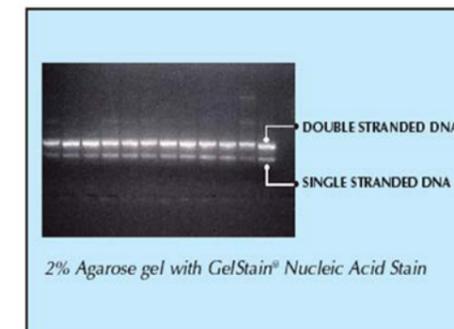
HLA typing is generally performed for 6 HLA loci (HLA-A, -B, -C, -DRB1, -DQB1 and -DP1) for compatibility between donors and patient. There is a higher risk of treatment-related mortality and overall survival in patients with anti-HLA antibodies undergoing HSCT. This raises the concern that pre-existing anti-HLA antibodies before and after allo-HSCT may affect clinical significance.



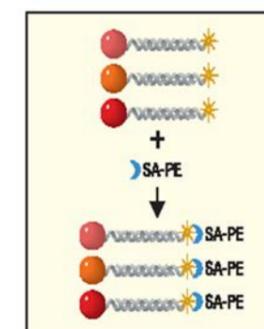
THE TEST PRINCIPLE



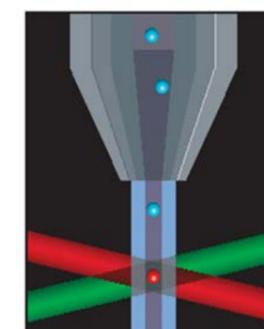
1. Amplify with biotinylated primers



2. Hybridize with beads



3. Label with SA-PE



4. Analyze in the fluoroanalyzer

4 BECKMAN COULTER NAVIOUS EX AND DXFLEX FLOW CYTOMETERS

Flow cytometry is a technique used to detect and measure physical and chemical characteristics of a population of cells or particles. In this process, a sample containing cells or particles is suspended in a fluid and injected into the flow cytometer instrument.

Navious EX

- The Navios offers up to three high powered solid state, independently-focused diode lasers with an innovative integrated optics flow cell design.
- It delivers up to 12 parameters for high complexity assays; sensitivity and resolution; and quality, reproducible results.
- With the 10 color capabilities of the Navios flow cytometer you can collect additional data points from each sample. This reduces the number of samples to prepare along with the possible errors that go with them.

DxFlex

- The DxFlex is a clinical flow cytometry platform that provides high sensitivity combined with ease of use.
- Offers multiparameter analysis of for autologous, allogeneic and manufactured cells used in clinical settings .
- 3 laser 13 color detection.
- Wavelength Division Multiplexing offers optimal signal resolution when using multiple channel analysis.
- Data analysis is rapid and allows easy export to clinical reports and other formats.
- The autoloader attachment provides hands free sample analysis enhanced sample tracking.
- Small footprint allows room for sample processing within the same space.

BENEFITS

- Equipped with electronics that provide accurate and efficient digital signal processing at high event rates over a wide dynamic range of fluorescence intensities.
- Up to three lasers - 405 nm violet laser, 488 nm blue laser, and 638 nm red laser.
- Solid state independently focused diode lasers.
- Integrated flow cell minimizes light loss.
- The analyzer delivers stable performance over long periods of time and across a wide range of operating temperatures.
- Thermoregulation system maintains the optical area at a consistent temperature.
- Wide angle scatter for distinguishing cells from debris and narrow angle scatter for detecting larger particles.
- Scatter signal amplification for submicron particle detection.

APPLICATIONS

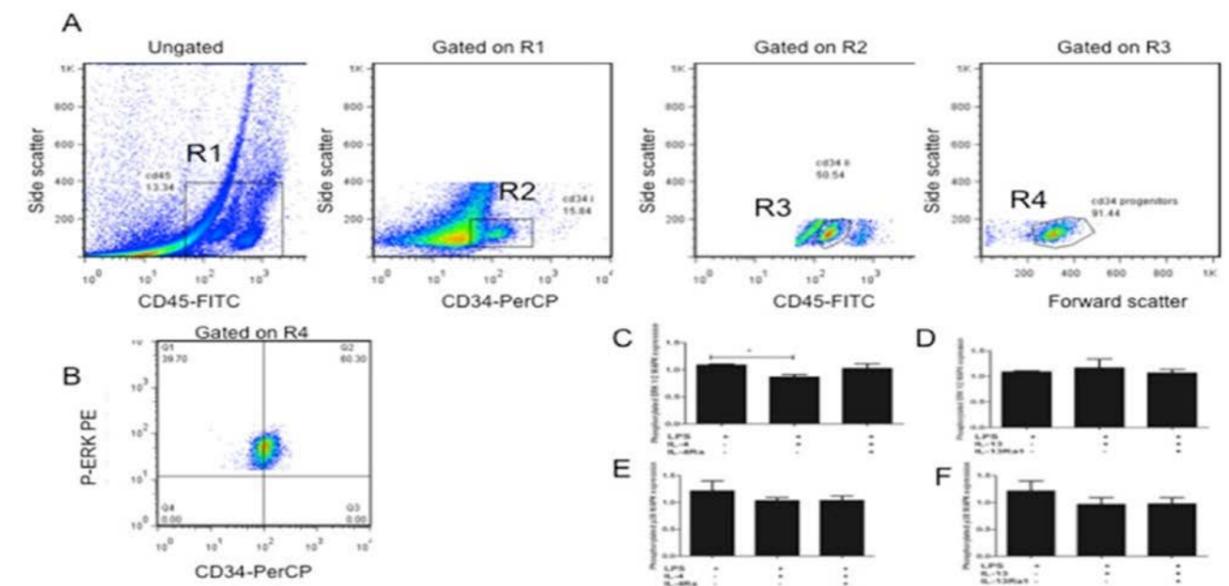
Hematopoietic Stem Cells Transplantation (HSCT)

There is a broad range of applications of flow cytometry to HSCT, including:

- Characterization of immunologic reconstitution.
- Pathophysiologic and diagnostic investigation of graft-versus-host, disease, viral infections, minimal residual disease.
- Detection of engraftment, and of alloimmunization against blood cells.
- Investigation of graft-versus-leukemia effect.
- Quantitation of HSC and in animal models of human transplantation and in gene therapy.

One of the most significant breakthroughs for the success of HSCT was the phenotypic and functional characterization of the primitive cells responsible for lymphohematopoietic reconstitution in transplanted patients. Discovery of the CD34 molecule present on many of these cells caused an explosion of new data on the mechanisms of normal, pathological and transplanted hematopoiesis. It also provided a very powerful tool to evaluate the engraftment requirements and repopulating potential of different types of grafts now employed in clinical HSCT.

- Characterization of immune cells
- Number of parameters: **100**
- Immune cells: **35**, Immune activations: **20**, Cancer blood cells: **20**, Hematopoietic stem cells obtention: **5**, Pluripotent stem cells characterization: **20**



CD34+ cells were analyzed using phospho-flow cytometry with a sequential multiparameter gating strategy. A. Enumeration of CD34+ progenitor cells in cord blood. Enriched CB CD34+ cells were stained with CD34-PerCP and CD45-FITC and analyzed by flow cytometry. Numbers of absolute CD34+ blasts were determined by expressing cell numbers in R4 as a percentage of cell numbers in R1. Nonspecific staining with isotype controls was set at 2% in all experiments. A representative experiment is shown. B. p-ERK expression on CD34+ cells (gated on the R4). A representative experiment of ERK staining is shown. Quadrant markers were set such that 2% or less of cells were stained with the isotype control. C. CB CD34+ cells were pre-incubated with anti-IL-4R α (C, E) or anti-IL-13R α 1 (D, F) Abs and stimulated with LPS and IL-4 (C, E) or IL-13 (D, F), respectively. Cells were stained with antibodies to intracellular ERK 1/2 (C, D) or p-38 (E, F) and analyzed using flow cytometry. A bar chart of the MFI expression index data is displayed for IL-4 (C, E) and IL-13 (D, F) data. Data are presented as mean \pm SEM of 4 experiments, and significant findings were determined using ANOVA with post hoc Dunnett comparison and 0 presented by an asterisk (*), $p < 0.05$.

5

MILTENYI BIOTEC MACSQUANT ANALYZER 10 FLOW CYTOMETER



The MacsQuant Analyzer 10 is a benchtop flow cytometer that allows highly sensitive, multi-parameter, and fully automated cellular analysis.

It offers a completely hands-free operation with the following automated features:

- Startup, cleaning and shutdown
- Compensation
- Cell labelling
- Magnetic enrichment
- Calibration and quality control
- Assays for various applications

BENEFITS

- High throughput of up to 15,000 events per second.
- Contains three lasers (405 nm violet laser, 488 nm blue laser, 640 nm red laser) and 8 detection channels for cellular analysis.
- Equipped with an enrichment unit for analysis of rare cell populations.
- Allows phenotypic analysis of fluorescent antibodies and functional analysis of labelled cells.
- Includes the MACSQuantify Software in a computerized system controlled by a touchscreen unit. This software is used for both sample acquisition and data analysis.
- Automated washing of uptake needle and sample injection port during and after cell processing, this self cleaning minimizes the possibility of carry-over effects.
- Automated multiple sample processing using different tube and plate racks, facilitating analysis of up to 96 samples.

APPLICATIONS

The MacsQuant Analyzer contains pre-programmed protocols for analysis of the CAR-T production process to ensure efficient cell isolation, analysis of expression of the CAR construct and monitoring of the final product to ensure the quality control for the in house CAR-T cells is at the highest level.

Other direct assays to determine the cell surface markers within any manufactured cell product can be automated in such a way that final reports are written for QA/QC review.

Standard flow cytometry experiments can be developed as needed that require control of documentation.



6

MILTENYI BIOTEC MACSQUANT TYTO CELL SORTER



Cell sorters group and divide cells into populations based on their intra- and extracellular properties. Doing so allows researchers to isolate pure populations of cells from a heterogeneous cell suspension. The Tyto is a benchtop cell sorter that offers a closed system for flow cytometric sorting using 10 parameters in a single-use, disposable cartridge. It utilizes a specialized microchip in the cartridge for high-speed and fully sterile sorting.

BENEFITS

- Equipped with 3 lasers (405 nm violet laser, 488 nm blue laser, 640 nm red laser) and 8 detection channels for sorting different populations.
- High sort rate of up to 55000 cells/hour.
- No risk of sample carryover or contamination due to single-use cartridges.
- Fast handling since laser alignment is not needed.
- The cartridge prevents aerosol and droplet formation, ensuring safety to user.
- Preserves cell viability and functionality by sorting under low pressure.
- Cells that are excluded from sorting parameters are sorted to a recovery location that can be resorted.

APPLICATIONS

Graft-versus-Host Disease (GVHD) is a chronic condition that affects nearly half of the patients who undergo allogeneic hematopoietic stem cells transplantation (HSCT). Patients with GVHD need to be administered with regulatory T cells (Tregs) to dampen the immune system following HSCT. The Tyto allows sterile sorting of defined Treg populations that can be used for suppression of GVHD. The high-speed sorting capabilities provides an ideal platform for delivery of specific cell populations to patients following HSCT.

7

BIORAD NGC DISCOVER PRO CHROMATOGRAPHY SYSTEM

NGC is an automated liquid chromatography system most commonly used for purification of proteins. In comparison to other NGC models, it is optimized for higher throughput to meet process development and laboratory-scale demands in preparative chromatography and protein isolation.

The instrument offers:

- Preplumbed system for QC-validated performance, ensuring more reproducible and highly pure separation
- A platform compatible with all NGC medium pressure columns and ChromLab Software, which includes method templates with column libraries for easy setup and analysis
- Real-time status display that shows current status of instrument modules



BENEFITS

- Achieves high resolution separation and meets high throughput demands using automated 100 mL/min sample pumps.
- Performs simultaneous four-wavelength detection of proteins, nucleic acids, and other biomolecules.
- pH valve monitors buffer pH and enables gradient separation at different pH values.
- Buffer blending valve provides automated inline buffer preparation at high flow rates for rapid purification.
- Column switching valve and sample inlet valve allow the user to perform multi-column purification and inject multiple samples respectively.
- Air sensors and the real-time status display show end of buffer and sample to protect against column damage.
- Provides flexibility in customizing system capabilities and fluidic schemes to fit application needs and optimize workflow.
- The integrated touch screen unit provides total control of the NGC system in modifying flow rates, detection wavelengths, and the general configuration for different runs.

APPLICATIONS

- Rapid purification of exogenously expressed proteins of interest
- Desalting of protein
- Removal of purification "tags" from expressed proteins
- Proteins can be separated over multiple columns to ensure uniformity of sample
- Polishing of purified proteins to remove contaminants

8

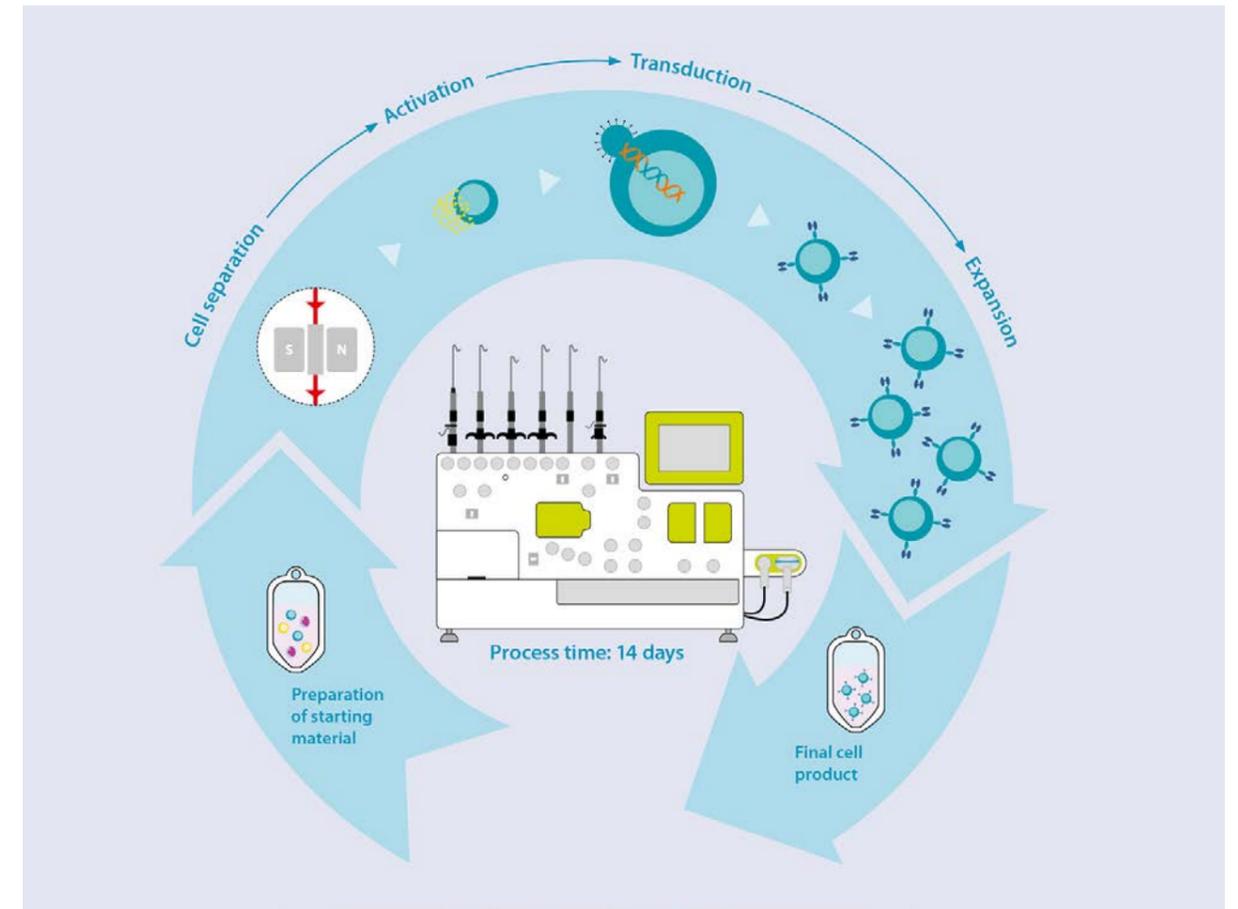
CLINIMACS PRODIGY



Manufacturing cells is one of the most important laboratory techniques in regenerative medicine, but it is also one of the main challenges because it consists of complex and labor-intensive procedures. The CliniMacs Prodigy provides an automated and closed system for safe, GMP-compliant, and standardized development of cell therapies. It has sensor-controlled cell processing capabilities and complete manufacturing protocols from cell preparation to final product, streamlining cell processing workflows for a variety of cell types. It integrates centrifugation, liquid transfer, and controlled incubation in a single device. With a single process setup, it ensures easy, safe, and timely manufacturing of cell products.

BENEFITS

- Fully closed system ensures safety, cost-efficiency and reproducibility.
- Fully integrated system eliminates the need for specialized handling of various instruments, reducing user-to-user variability and error.
- Equipped with a CentriCult unit that allows processing and cultivation within a single-use, temperature- and atmosphere-controlled chamber. The unit even contains a microscope to allow visualization of cells during the process.
- The CentriCult unit contains a centrifuge for concentration and washing of cells, and buffer exchange.
- The touch-screen interface allows users to edit manufacturing protocols, enabling flexibility and scalability.
- The computerized system offers step-by-step guidance during setup.
- Utilizes disposable tubing systems to ensure product and user safety.



APPLICATIONS

- CAR T cell manufacturing
- HSCT Graft and DLI engineering
- Adoptive immunotherapy: T cells, DCs, NKs
- Regenerative medicine: Heart and vasculature, liver, bone etc

Chimeric antigen receptor (CAR) T cells can be manufactured by the Prodigy for treatment of B cell acute lymphoblastic leukemia. White blood cells are first collected by leukapheresis and used as the starting material. In this workflow, lymphocytes are purified and enriched from the leukapheresis sample by magnetic cell separation. Enriched lymphocytes are then treated with T Cell TransAct to activate and expand T cells. Using a lentiviral vector, stimulated T cells are transduced to express CAR. After transduction, the Prodigy provides the optimal culture conditions for the incubation and expansion of CAR T cells. This workflow is automated to develop a GMP-compliant and reproducible cell product.

9

ILLUMINA MISEQ SYSTEM DNA SEQUENCE ANALYZER

Genome sequencing is a powerful tool in genetics research and counseling. Sequencing can be used to characterize genotypic profiles and monitor mutations in cell samples. Next-generation sequencing (NGS) is a technique that can sequence millions of fragments simultaneously. The input can be a whole genome, targeted regions of DNA, or RNA. The Illumina MiSeq System is an integrated NGS instrument that can perform cluster generation, amplification, sequencing, and data analysis. It utilizes Illumina sequencing by synthesis (SBS) chemistry, a proprietary NGS technology responsible for generating more than 90% of the world's sequencing data. With the power of NGS delivered in a benchtop instrument, the MiSeq System is the ideal platform for rapid and cost-effective analysis of small genomes and targeted regions.



BENEFITS

- Rapid turnaround time, where results are delivered within hours rather than days.
- Performs 600 bases of sequence data per read.
- Capable of automated paired-end reads.
- High throughput of up to 25 million reads per run, sizing up to 15 Gb of output data per run.
- Contains a user-friendly instrument control software that offers step-by-step guidance throughout the sequencing workflow.
- Provides access to BaseSpace Sequence Hub, which is the Illumina genomic cloud-computing platform that enables real-time data uploading, easy data sharing, and internet-based run monitoring. It also includes a secure storage solution, data analysis tools, and third-party analysis apps.
- Cost-effective alternative to other sequencing methods.
- Allows flexibility by providing adjustable read lengths, flow cell options, and choice of single or paired-end reads.
- Reduced error rates compared to other sequencing technologies.

APPLICATIONS

Prior to allotransplantation, human leukocyte antigen (HLA) typing is performed to ensure compatibility between donor and recipient. Matching donor to recipient reduces the risk of graft-versus-host disease (GVHD), which is a post-transplant complication. HLA genes are difficult to sequence due to homology with pseudogenes. They are also the most densely polymorphic region of the human genome, and the thousands of HLA alleles in the population are not well-studied. Conventional antibody and DNA-based methods of HLA typing require multiple assays and yield low resolution results. The Illumina MiSeq System overcomes these issues with NGS technology. It allows rapid and accurate sequencing and analysis of HLA genes for high-resolution and unambiguous HLA typing in a single assay.

10

TERUMO BCT QUANTUM CELL EXPANSION SYSTEM

The Quantum is an automated cell culture platform used for cell culture development for both commercial and research purposes. It can expand adherent cells, suspension cells, viral vectors and exosomes in a fully-integrated and closed system.



BENEFITS

- Compared to cell culture flasks, the Quantum reduces the risk of contamination by 99.8% by providing a closed system
- Eliminates the need to perform labor-intensive processes by integrating cell feeding, waste removal, and gas exchange until harvest. The instrument is equipped with a user-friendly touch screen to monitor and control these parameters
- Harvesting cells from the Quantum takes around 20 minutes, whereas harvesting cells manually takes a few hours
- Offers flexibility, scalability and reproducibility through customizable pre-defined protocols for consistent expansion of various cell types
- Maintains a controlled environment by minimizing fluctuations in temperature and gas concentration

11 ROCHE LIGHTCYCLER 480 REAL-TIME PCR SYSTEM

Polymerase chain reaction (PCR) is a method widely used in molecular biology to rapidly make millions of copies of a specific DNA sample, allowing scientists to take a very small sample of DNA and amplify it to a large enough amount to study in detail. PCR was invented in 1983 by Kary Mullis. It is used in the early stages of processing DNA for sequencing, for detecting the presence or absence of a gene to help identify pathogens during infection, and when generating forensic DNA profiles from tiny samples of DNA.



The LightCycler 480 PCR System is a high-performance, medium- to high-throughput PCR platform (96- or 384-well plates) that provides methods for gene detection, gene expression analysis, genetic variation analysis, and array data validation. This benchtop PCR device supports mono- or multicolor applications, and multiplex protocols. It is easily customizable to meet changing user requirements, and can be integrated into everyday use as a robotically controlled, automated high-throughput solution.

BENEFITS

- Allows the user to obtain fast, highly sensitive, and reproducible results for qualitative and quantitative detection of nucleic acids, mutation scanning, and SNP analysis.
- The cutting-edge thermal block and optical technology leads to excellent well-to-well homogeneity and maximized detection sensitivity.
- Allows the use of a wide range of probe formats (e.g., FRET or HybProbe probes, SimpleProbe probes, hydrolysis probes) and fluorescent dyes (e.g., SYBR Green I, ResoLight Dye, FAM, HEX, Cy5, LightCycler® Red 610, LightCycler® Red 640, and LightCycler CYAN 500).
- Buildable, modular real-time PCR platform to meet specific applications. Allows the user to flexibly switch between plate formats and thermal block cyclers in just a few minutes with no recalibration time, and benefit from additional user-friendly software modules.
- Ability to extract meaningful results via the state-of-the-art data analysis methods, in line with MIQE guidelines. Analysis of true raw data without the need for passive reference dyes or normalization plates.
- Gene Quantification
 - Gene detection
 - Absolute quantification
 - Relative quantification/gene expression analysis
- Genetic Variation Analysis
 - Melt-curve genotyping with labeled probes
 - Endpoint genotyping
 - High-Resolution Melting (HRM) Multiple Plate Analysis
- Detection and Quantitation of oncogenes and pluripotent stem cells genes
 - Number of parameters: **18**
 - Oncogenes: **6**, Pluripotent Genes: **10**, Other: **2**

APPLICATIONS

Hematopoietic Stem cells transplantation (HSCT): At present, real time PCR (qPCR) is the most fundamental, accurate and commonly used method to investigate mRNA levels and used to assess the expression levels of specific genes and also present an appropriate strategy for the evaluation of candidate reference genes for any stem cells differentiation.

Telomeres are repetitive nucleotide sequences found on the ends of chromosomes that ensure chromosome integrity by protecting chromosome ends from degradation or fusion. The telomere complex machinery is highly active in proliferating and differentiating stem cells. Telomeres progressively shorten with each cell division as a consequence of the "end replication problem".

This shortening impairs cellular proliferation and overall cellular regenerative capacity and is thus a useful indicator of cellular senescence. As such, links have been made between telomere length, aging, longevity, and aging-associated disorders. Telomere shortening also affects immune cells, and is a marker of aging hematopoietic stem cells. The telomerase complex is highly expressed and active in activated T cells and non-quiescent HSCs where it is required for HSC proliferation.

The LC480 system also constitutes a suitable and versatile real-time PCR platform in a routine laboratory setting for the diagnosis and monitoring of opportunistic viral infections in transplant recipients, by measuring human cytomegalovirus, Epstein-Barr virus, human herpesvirus 6 and BK virus.

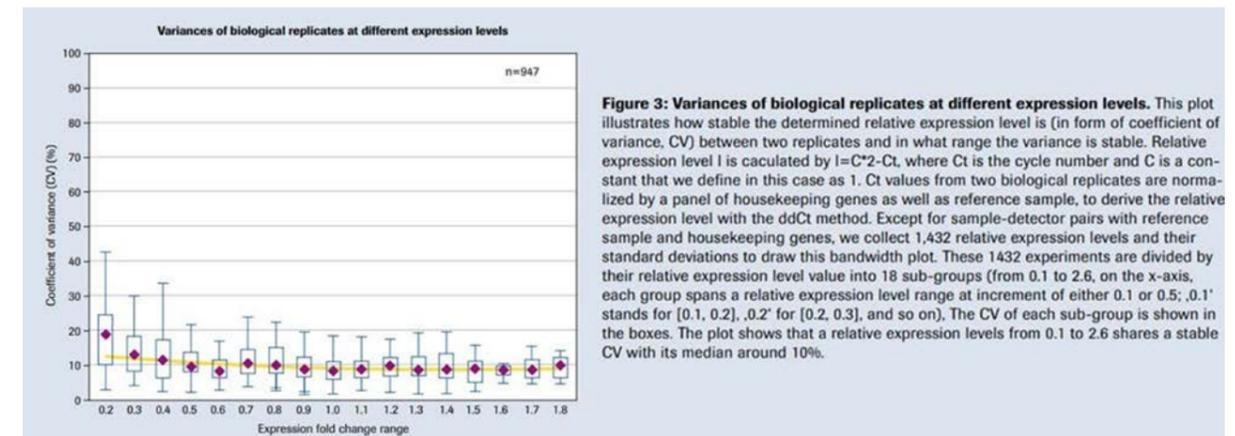
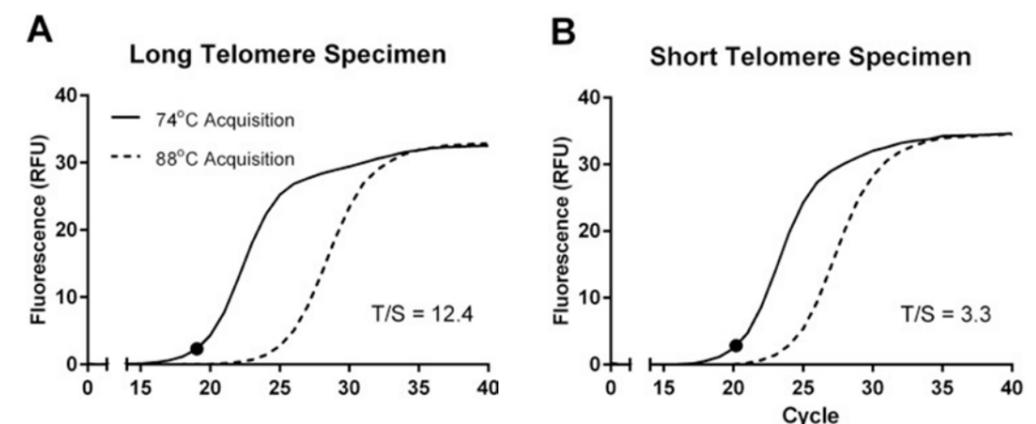


Figure 3: Variances of biological replicates at different expression levels. This plot illustrates how stable the determined relative expression level is (in form of coefficient of variance, CV) between two replicates and in what range the variance is stable. Relative expression level I is calculated by $I=C^2-Ct$, where Ct is the cycle number and C is a constant that we define in this case as 1. Ct values from two biological replicates are normalized by a panel of housekeeping genes as well as reference sample, to derive the relative expression level with the $\Delta\Delta Ct$ method. Except for sample-detector pairs with reference sample and housekeeping genes, we collect 1,432 relative expression levels and their standard deviations to draw this bandwidth plot. These 1432 experiments are divided by their relative expression level value into 18 sub-groups (from 0.1 to 2.6, on the x-axis, each group spans a relative expression level range at increment of either 0.1 or 0.5; .0.1' stands for [0.1, 0.2], .0.2' for [0.2, 0.3], and so on). The CV of each sub-group is shown in the boxes. The plot shows that a relative expression levels from 0.1 to 2.6 shares a stable CV with its median around 10%.

Source: <https://lifescience.roche.com/content/dam/RMS/lifescience/Documents/PDF/qPCR-Identification-of-Genes-Involved-in-Apoptosis-and-Cell-Cycle-Regulation.pdf>



Fluorescence curves of long and short telomere specimens in the LightCycler 480. The circles represent the threshold cycle of the 74°C acquisition. T/S, telomere/single-copy nuclear gene.

Source: Hsieh A. et al. J Mol Diagn. 2016 May; 18(3): 425-437.

12 BIOTEK LIONHEART FX AUTOMATED LIVE CELL IMAGER

Researchers need to obtain good quality data in a short period of time owing to the high volume of samples needed for statistically significant analysis. In today's fast-paced research world, scientists need a method for automated image analysis using high throughput technologies for fast data acquisition and analysis. Augmented Microscopy is the automation of image capture, processing, analysis and the development of publication-ready images and data.



- Lionheart FX Automated Microscope is a compact, inclusive microscopy system for a broad range of imaging workflows and offers up to 100x oil magnification, with fluorescence, brightfield, color brightfield, and phase contrast channels for maximum application reach.
- It provides incubation to 40°C and effective containment for CO₂/O₂ control, a humidity chamber optimizes conditions for long-term live cell imaging applications, and a dual reagent injector facilitates rapid kinetic assays.

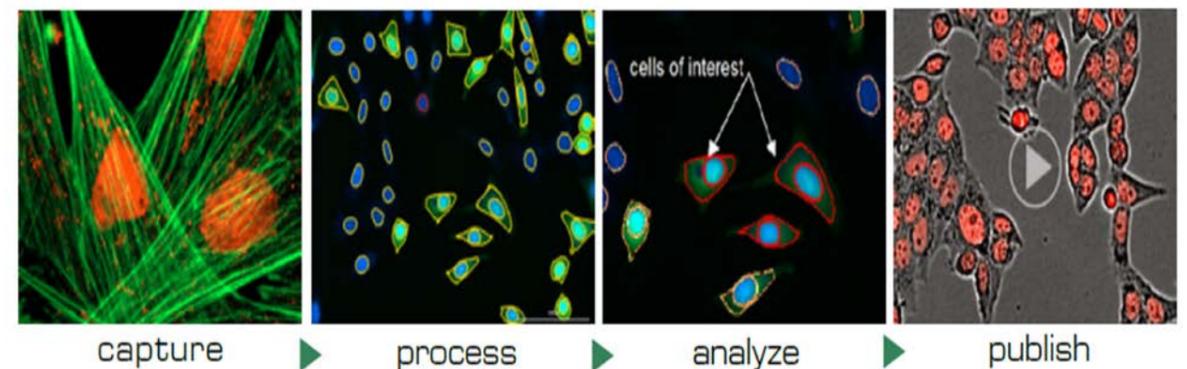
FEATURES / BENEFITS

- Automated digital microscopy with up to 100x magnification for the whole organism to sub-cellular imaging.
- Brightfield, color brightfield, phase contrast and fluorescence with image and laser autofocus to meet a wide range of imaging applications.
- Powerful Gen5 3.0 software with seamless image capture, annotation, analysis and movie making. Requires no extensive training.
- Automated kinetic live cell assays, with temperature and CO₂/O₂ control, humidity and reagent injectors.
- Auto Focus, Auto Exposure, Auto LED Intensity.
- Fully integrated and compact design offers quick installation and setup, no extensive training required.
- Label-free cell counting for cell proliferation assays.

APPLICATIONS

Fixed and live cell assay workflows by automated image capture, processing, analysis, including:

- Cell migration and invasion assays
- Live cell imaging
- High resolution microscopy
- Immunofluorescence
- Phenotypic assays
- Histology



Lionheart Fx, an automated live-cell imager, automated image capture, processing, and analysis to produce publication-ready data.

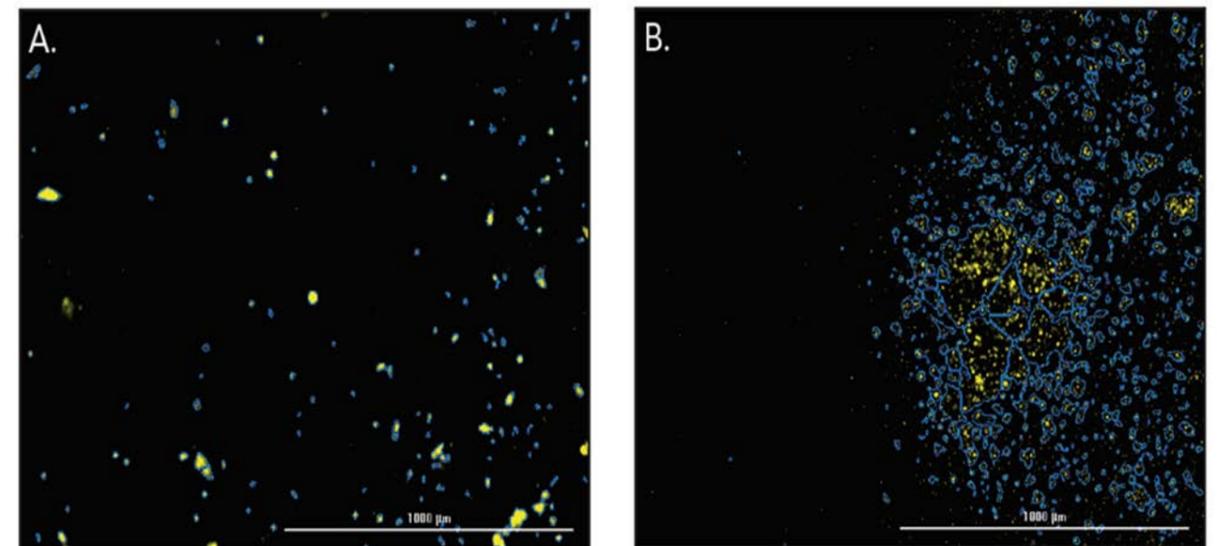


Figure: Cellular Analysis of Target Cell Cytotoxicity. 4x images show fluorescence from propidium iodide necrotic cell probe following 96-hour incubation. Object masks (in blue) placed around (A) 2D and; (B) 3D cultured target cells meeting cellular analysis criteria.

Source: <https://www.biotek.com/resources/application-notes/an-image-based-method-to-detect-and-quantify-t-cell-mediated-cytotoxicity-of-2d-and-3d-target-cell-models/>

13 BIOTEK'S AUTOSCRATCH TOOL

BioTek's AutoScratch Wound Making Tool automatically creates reproducible scratch wounds in cell monolayers grown in microplates, which are commonly used in migration and invasion assays.

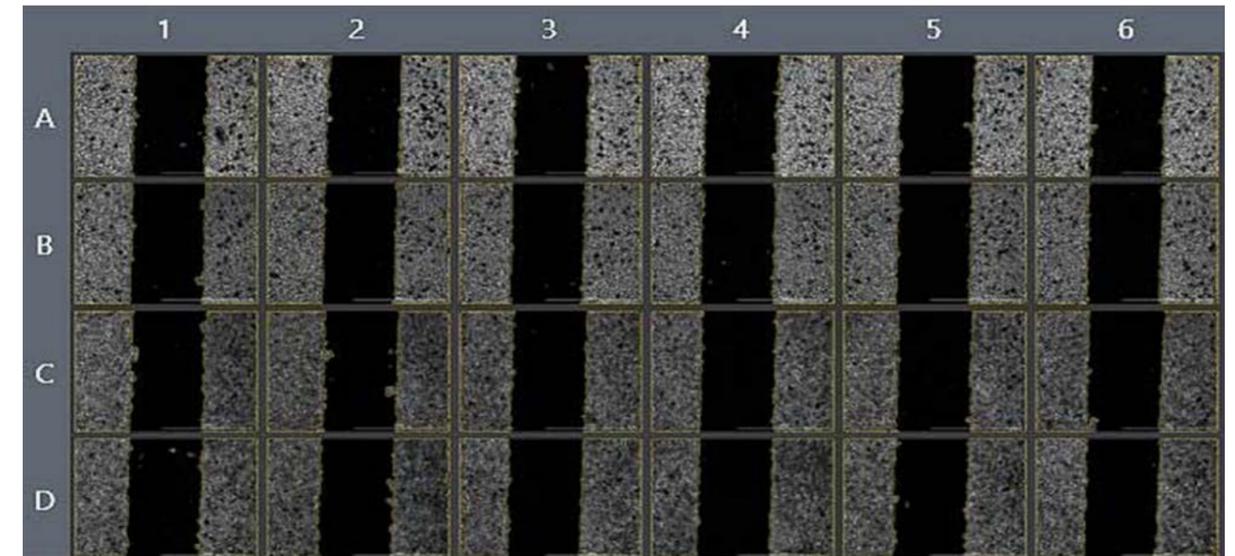


BENEFITS

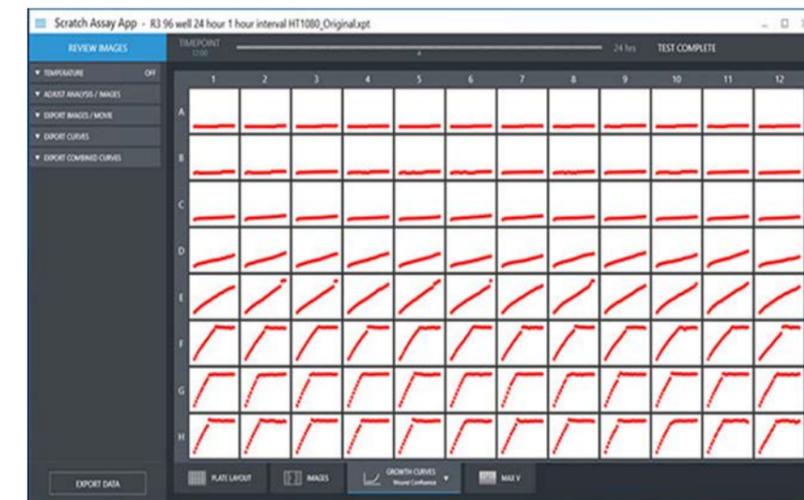
- Essential measurements such as % wound confluence and area can be easily determined. In addition, it precisely and efficiently automates the sample prep for imaging workflows with BioTek's Cell Imaging Multi-Mode microscopes.
- The Scratch Assay Starter Kit automates cell migration and wound healing assays.
- AutoScratch automatically makes consistent, repeatable scratch wounds.

APPLICATIONS

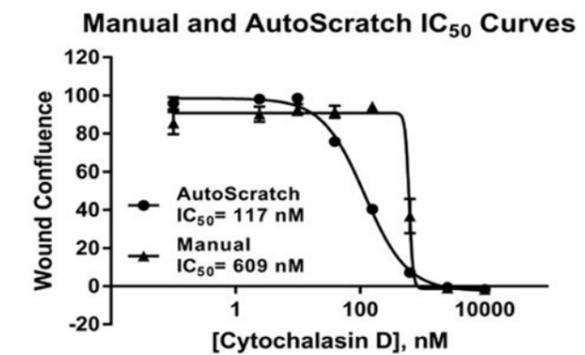
- **Stem cells:** Evaluate in vitro the regenerative capacity of stem cell-derived products using models of different tissues. Predict the action of stem cells in Transplantation and regenerative therapy.
- **Cancer research:** Guarantee the absence of cancer cells in stem cell preparations for regenerative therapy.



The Scratch Assay Starter Kit automates cell migration and wound healing assays: AutoScratch automatically makes consistent, repeatable scratch wounds.



The Scratch Assay App automatically calculates % confluence, wound width, and maximum healing rate (max V).



AutoScratch creates scratch wounds with excellent performance compared to manual methods.

14

THERMOFISHER CONTROLLED RATE FREEZER AND CRYOGENIC TANK

CryoMed Controlled Rate Freezer (CRF)

The CryoMed CRF is a GMP-compliant benchtop freezing unit that controls the cooling rate within the chamber and sample. It freezes samples at different cooling rates over a period of time to protect cells from undercooling and intracellular ice formation.

BENEFITS

- Achieves a uniform cooling rate of 1C per minute, preventing cellular damage
- Includes predefined and customizable freeze profiles
- Fully integrated freezer chamber, microprocessor control and printer allow users to input and modify freezing profiles
- Contains air-handling and LN2 injection ring system, and dual solenoid valves for precise temperature control and uniformity
- Equipped with a Java-based PC software for remote profile design and operation
- Chamber and sample temperatures are monitored by Type T thermocouples, providing real time responsiveness and reliable temperature performance

APPLICATIONS

The CryoMed allows cell therapy products to slowly reach -85C while protecting from intracellular freezing. Immediately placing samples into a cryogenic tank makes them susceptible to death and damage due to the formation of ice crystals during freezing. For this reason, storing product in dimethyl sulfoxide (DMSO) solution and freezing in a controlled rate freezer prior to cryopreservation reduces intracellular ice formation.



CryoExtra High-Efficiency Cryogenic Storage System

The ThermoFisher cryogenic tank is supplied with liquid nitrogen to maintain temperatures below -130°C for ultimate stability and long-term viable storage of cells. It is used to store cell lines, cell therapies, and valuable samples for over a year.

BENEFITS

- Capable of vapor phase storage, avoiding the hazards of liquid phase storage such as contamination and sample destruction
- Features automated temperature monitoring, advanced temperature monitor and alarms, and a lockable lid for sample protection
- Equipped with a microprocessor controller, allowing users to monitor temperature, control LN2 levels and filling status, and adjust alarms
- The vacuum insulated steel vessel minimizes temperature variations
- Hot gas bypass protects samples from warm N2 gas during fill cycle



15 MICROSCAN WALK-AWAY DXM1096

The DxM MicroScan WalkAway microbiology system delivers trusted detection of emerging and critical antimicrobial resistance with gold-standard¹ MIC accuracy. Designed with ease of use as a focal point, this bacterial identification and antimicrobial susceptibility testing (ID/AST) system provides streamlined workflows and enhanced performance compared to its predecessors.² The DxM MicroScan WalkAway system continues the legacy of innovation and high-quality products you have trusted for 40 years. Enable your laboratory to optimize patient care while reducing risks, costs and operational burden associated with detecting emerging antimicrobial resistance.

Microbial studies and testing in stem cell therapy and/or cryopreservation of stem cells require different settings than clinical labs where specific activities are expected to be performed such as validation of sterility test methods for intended use, environmental microbial monitoring, disinfectant effectiveness studies, media fills to assure aseptic competency, etc.

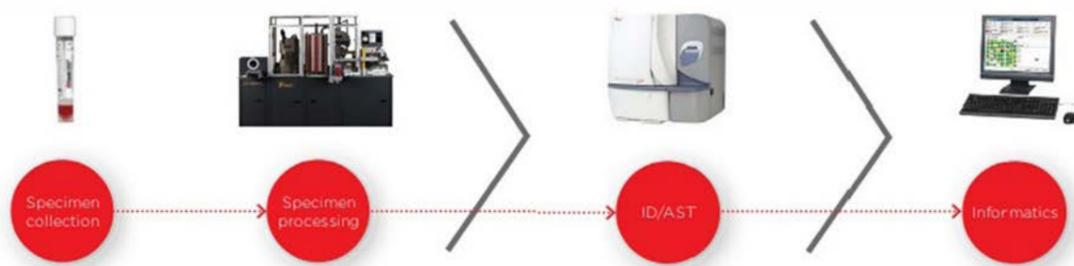
ADSCC Microbiology lab is a bio-safety level 2 laboratory with HEPA filter, class 2 Bio safety cabinet (Type A2) and Micro scan walk away DxM1096.

APPLICATIONS

- Automated bacterial/yeast identification and susceptibility testing system.
- Rapid fluorescent panels processed by the Micro Scan WalkAway system provide quick and accurate identification and susceptibility results for a wide range of aerobic bacteria.
- Supports multiple workload needs with both 40- and 96-panel capacity models.
- Automated incubation, test interpretation, and reagent control.
- 20+ year history of reliability.
- Provides an identification along with many different antibiotics on a single panel.
- Supports testing for difficult and slow-growing species.
- MicroScan offers a broad choice of panel formats:
 - Conventional overnight panels
 - Rapid ID panels
 - ESβL plus panels
 - MICroSTREP plus panels
 - Specialty ID panels
- MicroScan panels provide superior accuracy in detection of CRE, carbapenemase resistant Enterobacteriaceae, a CDC- and globally identified health risk.
- An extensive organism identification database.

Pre-analytical

Post-analytical



16 CRYOPRESERVATION



Collection

Patient's adult stem cells are collected as soon as he/she arrive to Abu Dhabi Stem Cell Center (ADSCC), following the doctor's order, using a cutting edge aphaeresis system.

Transport to the Lab

The whole blood containing bag are then sealed in a temperature-monitored shipping container. We will securely transport it to our state-of-the-art clean room laboratory in the ADSCC.

Quality Test

We receive and process blood bag collected for stem cell cryobiology during the whole year, which are analyzed by our experienced laboratory scientists for Total Nucleated Cells, and CD34+/CD45+ cell count, viability, as well as bacteriology, and fungal contaminants.

Process

The precious stem cells from the blood are separated, purified and concentrate.

Cryopreserve

The stem cells are prepared for cryogenic storage and frozen using a method that ensures complete protection from damage with the Thermo Scientific CryoMed Controlled Rate Freezer using sterile materials and cryosafe bags.

Cryotanks Storage

We place the frozen stem cells in our Thermo Scientific CryoExtra™ Controller cryotanks, containing liquid nitrogen (LN2) at -196°C. In the LN2 vapors at a temperature of -135 °C, the cells remain perfectly preserved for years.

Secure & Safe

Our high-tech Thermo Scientific system continuously monitors the frozen stem cells by the CryoExtra™ Controller. If they are ever needed, we perform another round of quality checks before transporting them in cryogenic tanks to any clinical centre in the city.

Regulated by Human Tissue Authority

The ADSCC stem cell bank has been licensed as a stem cell storage service in Abu Dhabi by the DOH.



QUALITY CONTROL

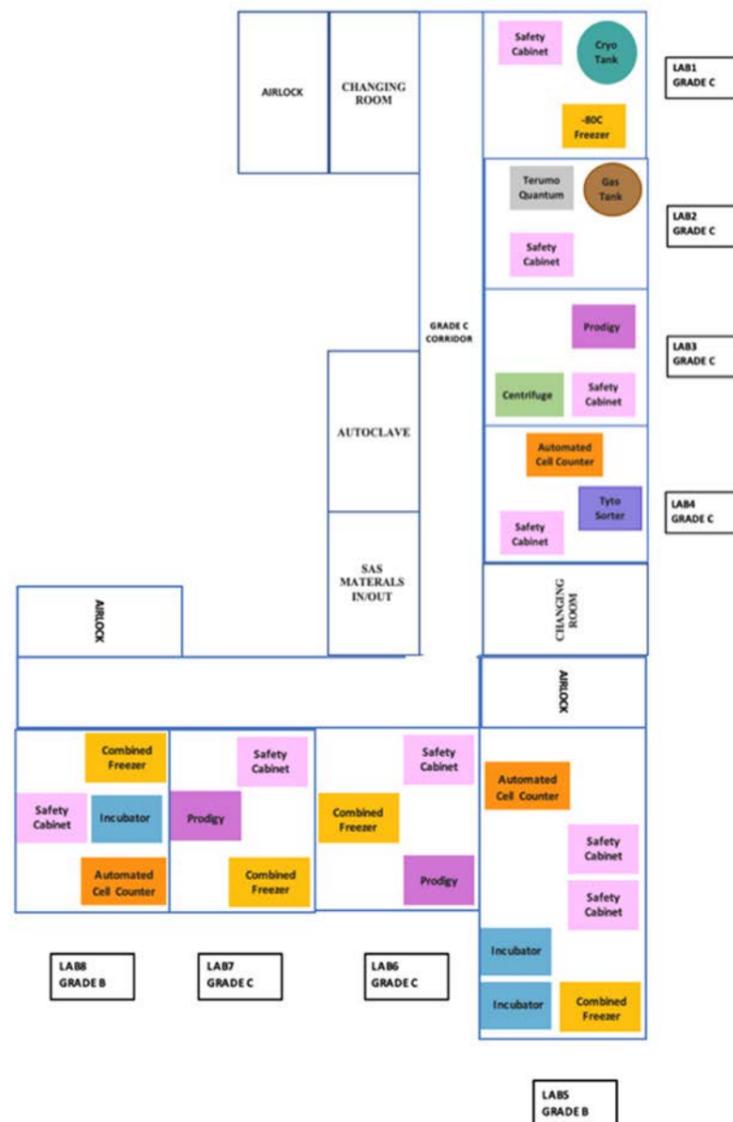
- Quality assurance activity in ADSCC Laboratory is associated with the aim to produce data with a maximum reliability.
- ADSCC Laboratory Quality control program consists of practical steps undertaken to ensure the full integrity of the released data.
- As part of the Quality Assurance program of ADSCC Laboratory, daily internal Quality Controls are done and are closely monitored.
- The internal QC involves the in-house procedures for continuous monitoring of operations and systematic day-to-day checking of the produced data to decide whether these are reliable enough to be released. The procedures primarily monitor the bias of data with the help of control samples and the precision by means of duplicate analyses of test samples and/or of control samples.
- In addition, the Laboratory is enrolled in CAP (College of American Pathologists) for their external quality control monitoring. The external QC involves reference help from other laboratories and participation in international interlaboratory sample and data exchange programs.

GOOD MANUFACTURING PRACTICES (GMP) LABORATORY

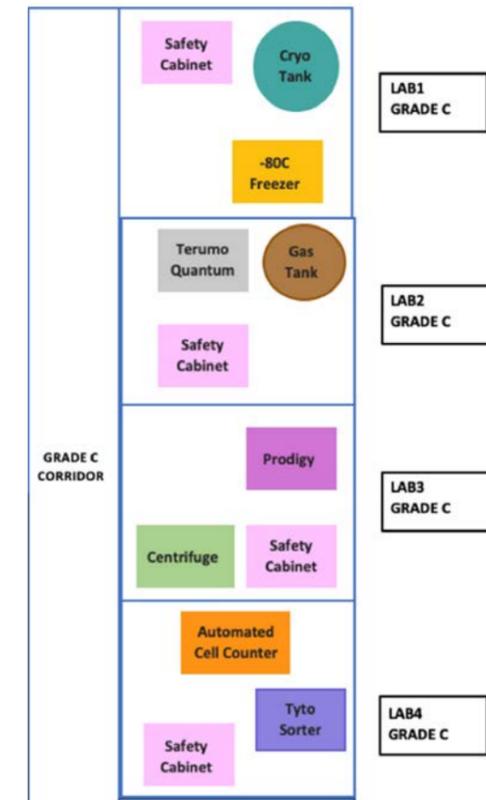
To achieve safety and efficacy, manufacturing cell products for therapeutic purposes requires rigorous standards to regulate the premises, procedures, processes, final product, and personnel. GMP laboratories follow and strictly adhere to GMP standards and regulations to avoid health hazards, reduce errors in manufacturing, ensure proper documentation, and minimize variances in final product.

GMP labs can be graded from A (strictest) to D (least strict) depended on the degree of cleanliness and sterility. ADSCC's GMP lab includes 2 B-type suites, and 6 C-type suites. In both suites, sinks and drains are prohibited, and the number of airborne particles is limited. The main difference between B and C-type suites are the physical parameters such as air changes, air filtration, room pressurization, and air velocity. B grade suites require higher degree of air changes, air filtration, room pressurization, and air velocity. Also, the maximum number of airborne particles is limited to $3520 \times 10^4 \mu\text{m}^3$. In ADSCC, grade B labs will be limited to cell culturing applications, and grade C for closed system cell isolation and expansion.

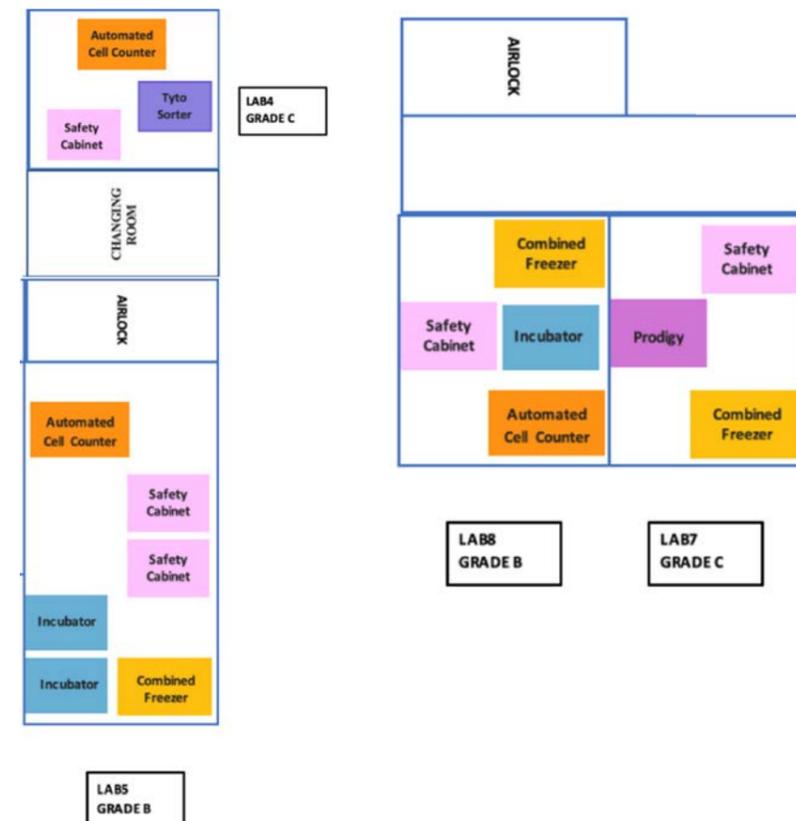
The layout of the lab is designed for filtered air flow, and GMP-compliant equipment are designed to have a small footprint to avoid impacting air quality and facility design. Each instrument with its own application must be placed in a separate room to reduce the risk of cross contamination.



As shown in the image on the right, Labs 1 to 4 are Grade C. Lab1 is used for cryopreservation and storing reagents, materials, and by-products. Labs 2, 3, and 4 house the Tyto Cell Sorter, Prodigy, and Quantum Terumo respectively. Labs 6 and 7 are dedicated to the Prodigy.



Labs 5 and 8 are B-grade labs that contain a set of incubators, safety cabinets, a freezer, and an automated cell counter with the purpose of cell culturing. An air lock room separates Grade C and B labs to maintain a higher pressure in B-type labs.





ADSCC

مركز أبو ظبي للخلايا الجذعية
ABU DHABI STEM CELLS CENTER

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