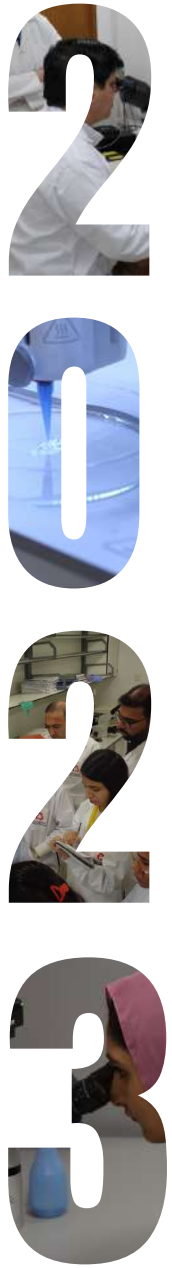
آغا خان یونیورسٹی
THE AGA KHAN UNIVERSITY

Centre for Regenerative Medicine and Stem Cell Research



@ AKU-CRM

OUR **BOLD RESEARCH IDEAS** ARE **WINNING** EXTERNAL SUPPORT

This year, our researchers secured two extramural grants to pursue their research endeavours. Winning these competitive grants reflects the increasing confidence in the capacity of our researchers to pursue bold and transformational research ideas.

Advanced Gene Editing Therapies for β-thalassemia and Sickle Cell Disease (SCD)

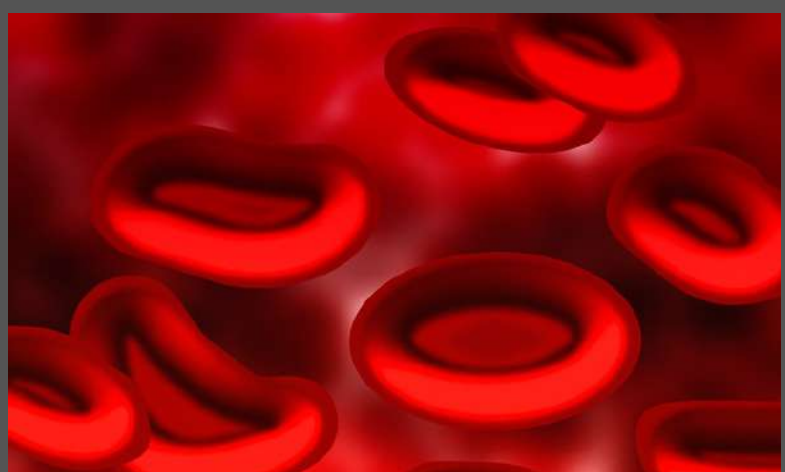
Both β-Thalassemia and SCD are hereditary conditions, arising from genetic anomalies affecting the production of hemoglobin, an important protein responsible for transporting oxygen in our bloodstream. In Pakistan, where many marriages occur within families (such as cousins), more than 70% of marriages involve relatives. This increases the chances of inheriting these genetic errors, causing significant suffering and economic strain on society. Dr Afsar Mian has received a US$ 1.5 million grant from Wellcome Leap to develop advanced gene editing therapies for these diseases.

The research team aims to explore two advanced gene editing techniques: base editing and prime editing.

These techniques have gained popularity due to their precision, specificity, and minimal unintended side effects compared to CRISPR-Cas9 technology.

The initial testing phase of this new gene editing therapy will take place in the laboratory, where stem cells with the remarkable ability to develop into any cell type will be collected from Thalassemia and SCD patients. If laboratory tests prove successful, the next step will involve pre-clinical trials on animals.

Generating Red Blood Cells (RBCs) in the Laboratory



In a context like Pakistan, individuals suffering from blood diseases and disorders face challenges with the availability of safe blood products to meet their healthcare needs. And when available, they are not accessible. This situation underscores a pressing need for improved healthcare infrastructure and policies that ensure the equitable distribution of essential medical supplies, particularly for those with blood-related illnesses.

Generating RBCs as a shelf product for transfusion therapies provides hope to patients suffering from diseases such as anaemia, sickle cell disease, or cancer. This ambitious goal demands a profound understanding of how, precisely, a normal stem cell differentiates towards erythroid lineage.

Dr Hammad Hassan and Dr Sheerien Rajput secured a PKR 20 million grant to develop artificial red blood cells in a laboratory setting. The fund has been granted by the Pakistan Innovation Fund (PIF), supported by the Ministry of Planning Development and Special Initiative, Government of Pakistan.

CREATING AND SHARING KNOWLEDGE

Our researchers shared their research findings through publications and conference presentations nationally and globally

CRM Researchers Develop a Novel Research Method to Isolate Exosomes

In a study published in the International Journal of Molecular Sciences, Dr Afsar Mian and his team introduced an innovative approach for isolating exosomes. Exosomes are tiny vesicles that act as carriers of molecules within the body and have gained considerable interest in the medical field due to their potential in drug delivery applications.

Traditionally, isolating exosomes has been a complex and costly process, limiting accessibility to research and therapeutic applications. However, Dr. Mian's team has introduced a method that not only streamlines this process but also reduces the associated costs significantly.

This breakthrough has broad implications. The newfound method's cost-effectiveness makes it feasible for a wider range of research institutions and medical facilities to engage in research involving exosomes. Furthermore, the applicability of this method extends beyond research accessibility. The ability to efficiently isolate exosomes opens doors to diverse therapeutic avenues. Exosomes hold promise as vehicles for targeted drug delivery due to their ability to transport therapeutic molecules to specific cells within the body. Therefore, the development of a more accessible and cost-effective isolation method paves the way for enhanced exploration and utilization of exosomes in various therapeutic interventions, potentially revolutionizing drug delivery strategies in the future. **Read more >>**

Nano Titania Particles: Superhero Allies Against Cancers

CRM's researchers contributed a book chapter titled "Nano Titania Applications in Cancer Theranostics" in Updates on Titanium Dioxide that discusses how recent advancements in nanotechnology involving nanoscale titanium dioxide (TiO2) particles are gearing up to combat cancer in a whole new way.

The significance of this contribution lies in its synthesis of recent research findings and future prospects in the field. By exploring the applications of nanoscale TiO2 particles, CRM's researchers provide insights into the evolving landscape of cancer therapy, offering a glimpse into innovative approaches that hold promise in advancing the fight against cancer. **Read more >>**

Taking Forward the Stem Cells Ethics Dialogue

CRM's interim leadership and researchers published an article in the Pakistan Journal of Medical Association titled "The Lanscape of Stem Cell Research in Pakistan". This article serves as a clarion call, spotlighting the imperative to fortify the comprehension of ethical considerations, enhance existing guidelines, and fortify stem cell-related regulations within local contexts. **Read more >>**

Exploring Immunophenotypic Expression Patterns in Multiple Myeloma Cases

AKU-CRM faculty Dr Sheerien Rajput along with researchers from AKU's East Africa campus published a study titled "Immunophenotypic expression profile of multiple myeloma cases at a tertiary hospital in Nairobi Kenya" in Frontiers in Medicine journal. The study aimed to enhance understanding of the disease's characteristics within the East African population. **Read more >>**

Innovative Approaches in Leukemia Treatment

CRM faculty Dr Afsar Mian was amongst the distinguished speakers at the Research Showcase held as part of AKU's 40th-anniversary celebrations. He presented a talk titled "Roadmap for Drug Development against Resistant/Refractory Leukemia," and shared his research and insights for combating this formidable disease through novel treatment approaches.

Revolutionizing Therapies Hemoglobin Disorders

Dr Afsar Mian and his team showcased their research at the European Hematology Association 2023 Congress. Their work focused on some of the key milestone achievements for inducing fetal haemoglobin using CRISPR-Cas9 technology.

EMPOWERING THE **NEXT** GENERATION OF **STEM CELL RESEARCHERS**

We focused on empowering young researchers through various skill-building initiatives.

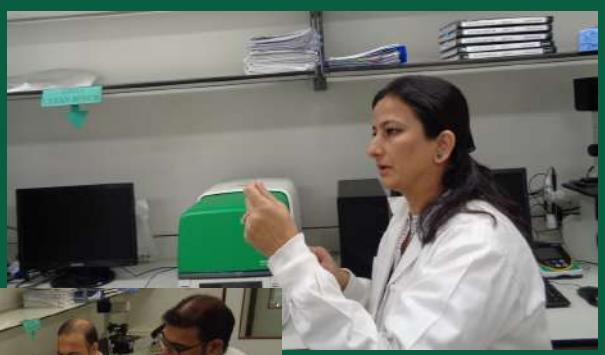
Stem Cells: A New Frontier in Surgery

CRM and the AKU Surgery Department jointly organised a first of-its-kind conference "Stem Cells: A New Frontier in Surgery" in Pakistan. Experts in stem cell research and regenerative medicine converged with clinicians to exchange knowledge and expertise.

Including a series of workshops on the basics and applications of stem cells, gene editing technologies, and cell reprogramming, the conference provided opportunities for new collaborations, discussing current research and setting priorities for the future of stem cell therapies in surgery.

Cells that Travel Back in Time

A two-day workshop was organised on **“Human Somatic Cell Reprogramming, hiPSCs Derivative & Culture”** directed by Dr Jahan Salma. The workshop's impact extended beyond theoretical learning. By offering hands-on experience, attendees gained invaluable insights into the advanced techniques. The interactive nature of the workshop fostered an environment conducive to learning, allowing participants to ask questions, engage in discussions, and troubleshoot real-time challenges.



3D Bioprinting Horizons

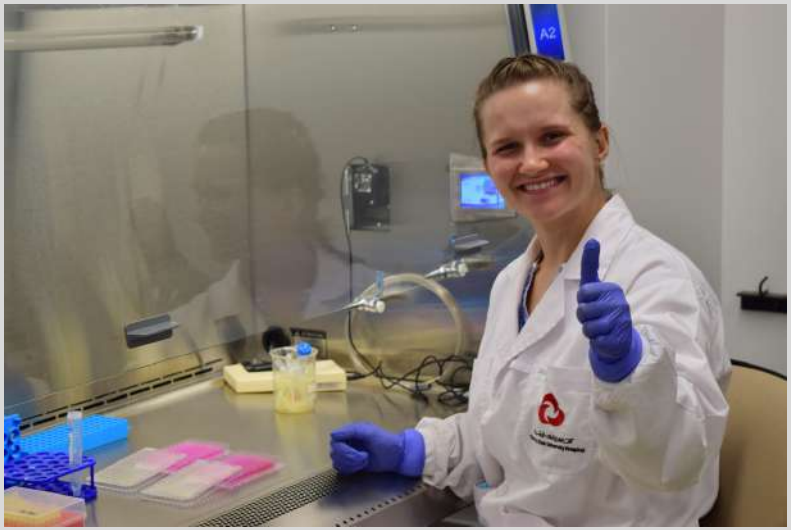
A workshop on **“3D Bioprinting Horizons: Applications in Tissue Engineering”**, by Dr Sheerien Rajput provided participants with hands-on training on 3D bioprinting technology and its role in tissue engineering. Attendees left equipped with not just theoretical knowledge but also practical skills, poised to harness this technology's capabilities for innovative advancements in the field.

COLLABORATIONS AND PARTNERSHIPS

We focused on international and national collaborations, expanding horizons, and empowering researchers through skill-building initiatives and capacity-building exchanges and talks.

Guest Lecture on Nanoparticles

CRM hosted a distinguished guest, Dr Sulalit Bandyopadhyay, Associate Professor of Particle Engineering and Hydrometallurgy at the Norwegian University of Science and Technology (NTNU), Norway. Dr Bandyopadhyay delivered an insightful lecture titled "Functionalizing Nanoparticles for Biodiagnostics Applications." His expertise shed light on the extraordinary capabilities of specialized nanoparticles, exploring their pivotal role in early disease detection, pioneering imaging methodologies, and innovative therapeutic advancements. NTNU is academic collaborator in our World Bank-supported Grand Challenge Fund (GCF) project.



Student Exchange Program

Through the GCF project, CRM facilitated a student exchange programme. This allowed students from the National University of Science and Technology (NUST), Islamabad, the National Institute of Biotechnology and Genetic Engineering (NIBGE), Faisalabad and the NTNU, Norway to get hands-on training at CRM.

Collaborative Research Ventures

CRM faculty and researchers visited Norwegian University of Science and Technology (NTNU). This visit was marked by an immersive engagement at NTNU's state-of-the-art Particle Engineering Centre, a hub renowned for pioneering advancements in scientific research. The CRM team seized this invaluable opportunity to utilize the cutting-edge facilities to conduct important phases of their research efforts. The visit also included insightful talks by Dr Afsar Mian fostering a vibrant exchange of ideas, forging robust connections, and promoting a mutual sharing of expertise between CRM and NTNU, paving the way for research advancements.

OUR **RESEARCHERS** INDUCTED TO **AKU'S PhD PROGRAM**

This year we shared proud moment with two of our researchers Safana Farooq and Karim Ruknuddin who were accepted into the AKU's faculty of health sciences PhD program. This achievement not only underscores their dedication but also paves the way for their continued professional growth and fulfillment of academic aspirations.

Karim Ruknuddin

Safana Farooq

CELEBRATIONS @AKU-CRM

The year resonated with various vibrant moments exemplifying our commitment to honoring and acknowledging the dedication of our team.

Celebrating Women in Science

In March, AKU-CRM observed International Women's Day celebrating the contributions made by our female scientists and researchers who are making strides in the field of stem cell science in Pakistan.

Breast Cancer Awarness Day

In October, AKU-CRM researchers passionately observed Breast Cancer Awareness Month. This month serves as a poignant reminder of the impact and importance of raising awareness about breast cancer.

WELCOMING OUR NEW TEAM MEMBERS

We welcomed another pool of brilliant and dedicated research associates and postdoctoral fellows who joined us in our research projects and core laboratory team.

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Established in 2016, the Centre for Regenerative Medicine and Stem Cell Research at AKU aims to design novel therapies for major diseases by developing a deeper understanding of disease processes through functional basic science research. We have a small, passionate team of researchers working with our international collaborators at the University of California, San Francisco and other universities on exciting research programs. Most of these programmes are in their exploratory phase. For more information, visit our website.

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crm.aku.edu

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