SIDRA MEDICINE | RESEARCH

Annual Report 2022

سدرة للطب
Sidra Medicine

SIDRA MEDICINE

RESEARCH

Annual Report 2022

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WELCOME NOTE BY CRO

2022 marked a significant step in realizing Sidra Medicine's research mission to deliver hospital-wide precision medicine, with research technologies and innovation continuing to play a prominent role in every patient's journey.

Indeed, by leveraging the lessons learned from the pandemic, we were able to accelerate the integration of research into clinical care pathways, enabling our researchers to take a more detailed view of individual patient challenges, and facilitating more flexible, responsive, and innovative translational research.

The impact of research on patient care was seen at multiple levels, from diagnosis onwards, and as much as 57 percent of our research studies had a clinical lead.

The pandemic highlighted too the need for research funding, and we are pleased to confirm that grants increased in 2022, with 15 total grants from Qatar National Research Fund and external funds, totaling almost QR11 million.

Included among these are two major international grants from the Juvenile Diabetes Research Foundation (JDRF), which funds leading scientists across the world to deliver possible cures and life-improving breakthroughs in the fight against type 1 diabetes. The JDRF grants will fund two research projects with Sidra Medicine scientists to advance predictions of type 1 diabetes among susceptible children using emerging technologies.

The last year also saw our scientists and clinicians publishing more than 250 papers, with close to 50 percent of Research Branch publications appearing in the top 15 percent of international journals.

It is with pride that we note that three Research Branch publications appeared on the covers of international journals, The Lancet Oncology, Nanoscale and Advanced Materials: a groundbreaking study on pediatric cancer tumors; an in-depth study that indicates fasting as a possible immunotherapy for treating cancer; and a large-scale genomic study co-led by Sidra Medicine researchers that helped unveil cancer susceptibility among Arab and Middle Eastern populations.

The latter study is the first of its kind in the region and used state-of-the-art bioinformatics and statistical genetics methods to analyze the genomes of more than 6,000 Qataris, representing a remarkable national effort to understand the genetic basis of cancer.

Dr. Khalid A. Fakhro
Chief Research Officer

We are also pleased to confirm a Memorandum of Understanding (MoU) signed with Microsoft to facilitate our digital transformation goals at a time when we are scaling up our genomic research capabilities. Such transformation will enable our scientists to perform complex data operations and build an ecosystem that can facilitate genomics computing.

In alignment with Sidra Medicine's commitment to capacity building, we continued to facilitate invaluable work experience, skills development and networking opportunities for young adults beginning their careers in science, medicine and public health, training more than 60 students and mentoring four PhD students to graduation.

In all, 2022 represents a year of innovation and making precision medicine a reality. We extend our appreciation to all who remained focused on helping us deliver on this mission, not just for the good of our patients and their families, but for the benefit of future generations.

LEADERSHIP STRUCTURE

Khalid Fakhro
Chief Research Officer

Rashid Al Ali
Executive Director
Research Core Facilities
and Digital Health Core

Max Renault
Director
Research Operations
and Services

Davide Bedognetti
A/Executive Director
Division of
Translation Medicine

RESEARCH MISSION AND STRATEGY

2022 Our year of Innovation and Making Precision Medicine a reality.

Our Vision

To establish a strong, clinically oriented biomedical research program, and to develop a national resource of genomic information that improves health in Qatar and the region.

Our Mission

We will deliver a hospital-wide Precision Medicine Program for Sidra Medicine, built upon the philosophy that research technologies and innovation should play a prominent role in every patient's journey at Sidra Medicine.

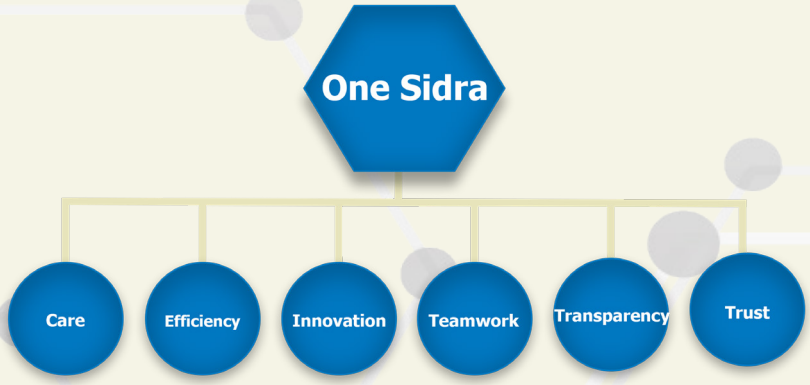
Our Strategy

Patient Driven Research
Advanced Diagnostics
Personalized Therapy

These strategic pillars imply a close integration of research into clinical pathways, establishing a hospital-wide biorepository, and employing innovative technologies to improve patient diagnosis and personalized treatment. This requires close collaboration, trust and interactions between patients, trainees, physicians, and researchers within Sidra Medicine, as well as in Qatar and around the world to advance care at Sidra Medicine. These foundations set the scene for Sidra Medicine to become a reputable institution of Precision Medicine, leading in clinical trials and in the publication of high-impact discoveries. In summary, this strategy will set apart from its peers in the local, regional, and international context, positioning Sidra Medicine as a unique Academic Medical Center serving patients from Qatar and abroad.
These aims are underpinned by a strong culture of innovation, and recognition of Sidra Medicine's intellectual property and technical know-how by leveraging, for example, digitalized healthcare and

Our Values

OneSidra - Innovation, Efficiency, Trust, Transparency, Teamwork, Care.



INTERNAL RESEARCH COUNCIL

As part of the IRC responsibilities, the committee has been reviewing the scientific merit and alignment of all clinical trials submitted by both Research and Clinical Investigators and will continually and critically review existing research projects and evaluate their impact.

Developing a national resource for genomic information on the population of Qatar to further research that improves health in Qatar and the region has largely been established as Sidra Medicine is now the National Sequencing Core, which does Sequencing and Bioinformatics on large scale, primarily for the Qatar Genome Program and internally for patients.
The duty of the IRC is to strengthen Clinical Research integration and make Sidra Medicine one of the best institutions in the world for Clinical Research.

As a first step, and out of the evaluation of research presented by clinicians and researchers, multiple Projects will be mapped into Research Programs. The following clinical-research Programs (working titles) were identified by IRC and approved by the Research Committee:

- Genetic and Metabolic Disorders (including Congenital malfunctioning)
- Neurological Disorders
- Fertility and Pregnancy Complications
- Cancer
- Immune Dysregulation

Clinical-research program areas were identified based on alignment with Sidra Medicine's Precision Medicine Pillars and satisfaction of all the following criteria:

- Publication track of clinicians and investigators conducting research in these areas
- A track record of successful external funding for projects in each program
- More than five PIs and/or senior clinicians are currently working in this area
- Goodness of fit between technologies and expertise already available within the Research Branch and the types of samples/ investigations required by clinical care
- Activity of previously formed interest groups constituted by researchers and clinicians
- Interest of the clinical counterpart in participating in research activities
- Active participation/leverage of research core facilities and platforms in assay development

CHAIRPERSON
Khalid A. Fakhro
Chief Research Officer

VICE CHAIRPERSON
Ibrahim Janahi
Division Chief Pediatric Pulmonology

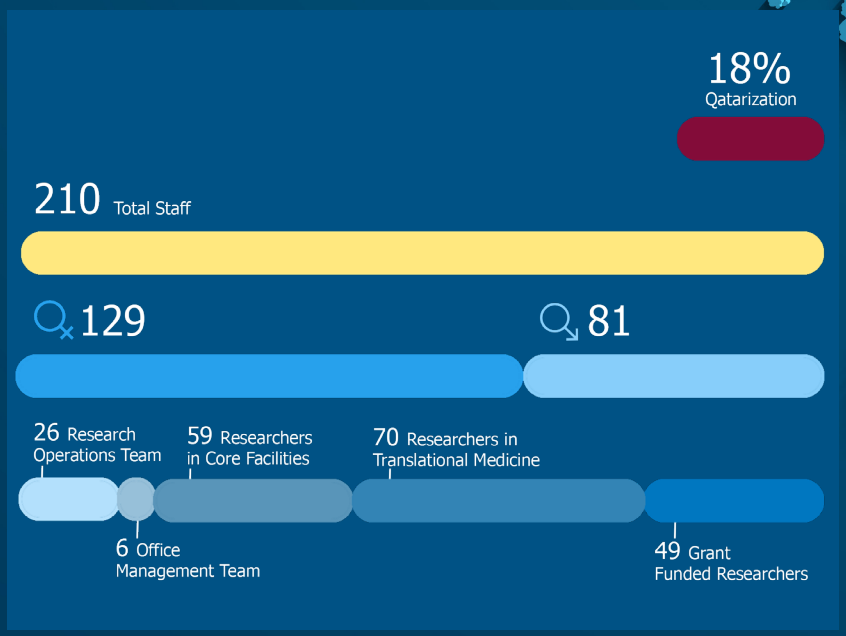
MEMBER
Davide Bedognetti
Acting Executive Director Translational Medicine

MEMBER
Mamoun Elawad
Division Chief Gastroenterology

MEMBER
Souhaila Al Khodor
Director Maternal and Child Health Division

MEMBER
Colin Powell
Senior Attending Physician Emergency Department

SIDRA MEDICINE:
OUR RESEARCH AT A GLANCE



34 Nationalities at Sidra Research

Algeria
Australia
Azerbaijan
Bahrain
Belgium
Canada
China
Egypt
France
Germany
India
Iran
Iraq
Italy
Jordan
Lebanon
Morocco
Netherlands
New Zealand
Oman
Palestine
Philippines
Portugal
Qatar
Saudi Arabia
Somalia
Spain
Sudan
Syria
Tunisia
UK
Ukraine
USA

COLLABORATIONS

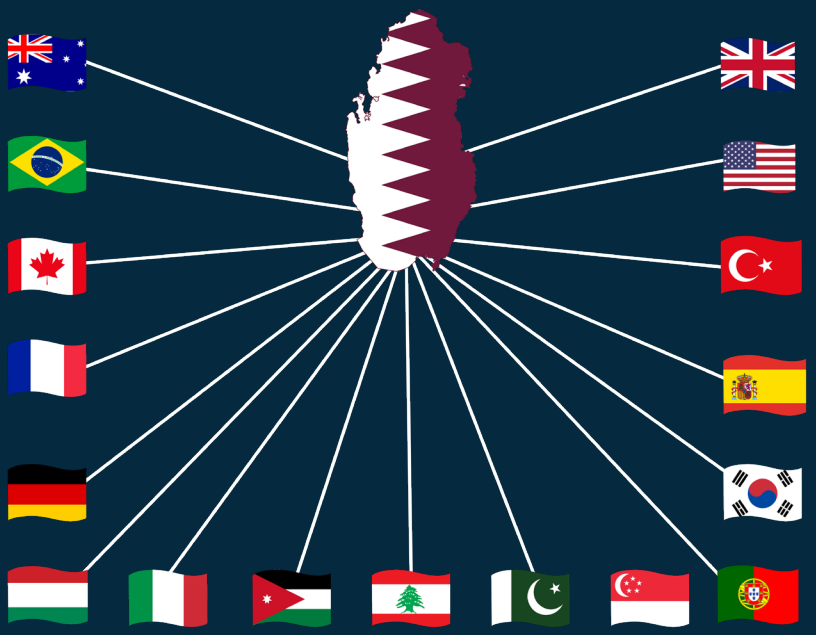
121
Total Collaborations

49
International Collaborations

Countries we have international collaborations with:

Australia
Brazil
Canada
France
Germany
Hungary
Italy
Jordan
Lebanon

Australia
Brazil
Canada
France
Germany
Hungary
Italy
Jordan
Lebanon



73
Local Collaborations

Local Institutions we collaborate with:

Anti - Doping Lab Qatar
Hamad Medical Corporation
Weill Cornell Medicine - Qatar
Equine Veterinary Medical Center
Hamad Bin Khalifa University
Northwestern University Qatar
Qatar Museum Authority
Qatar University
Qatar Biobank
Texas A&M University at Qatar
University of Calgary

PUBLICATIONS

250+
Sidra Medicine-affiliated peer-reviewed scientific papers published in 2022

104
Research Branch papers published in the last 12 months

42%
of publications in the top 15% of Internationally recognized journals

21
Research Branch Investigator average H-Index for 2022

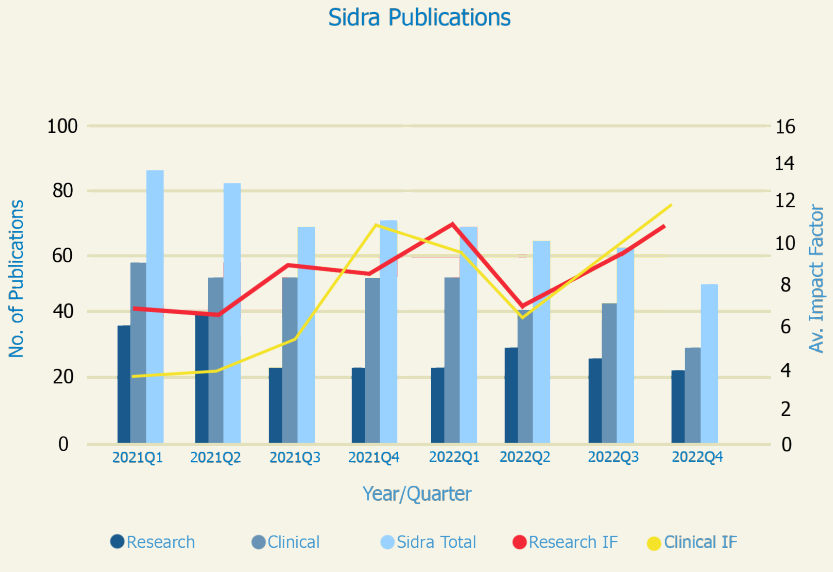
57%
of research studies have a clinical lead/co-investigator

9.6
Mean impact factor for Research Branch publications in 2022

44
feature in top 15% of journals worldwide (IF>5.5)

17
Research papers in the top 2% of journals worldwide (IF>13.3)

2020-2021 Sidra Medicine Publications



RESEARCH DIVISIONS

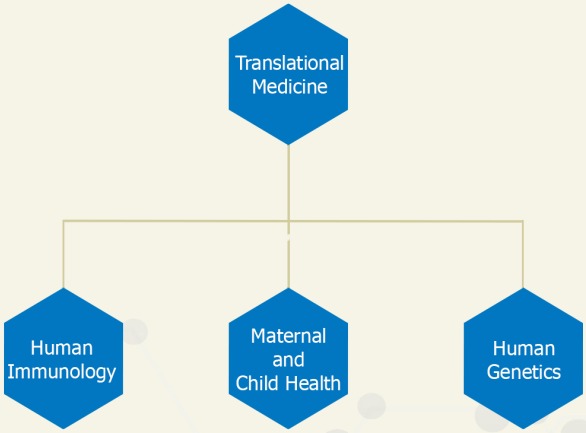
SCIENTIFIC DIVISIONS

TRANSLATIONAL MEDICINE

The Translational Medicine department is a key enabler for Sidra Research's strategy, which will lead to the establishment of Sidra Medicine as a world-class academic medical center and a destination for patients seeking the best available care in the region. The translational medicine department will focus on the development and implementation of precision medicine approaches. The Department of Translation Medicine is divided into three divisions, where all research groups fall under Human Immunology, Maternal and Child Health and Human Genetics. As a result of the commitment of Sidra Medicine to innovation in the field of precision medicine, the research groups at Sidra Medicine are engaged in research activities leveraging high throughput profiling technologies in the context of patient-based research.

A/EXECUTIVE DIRECTOR
Dr. Davide Bedognetti

Dr. Davide Bedognetti, MD, PhD is the A/ Executive Director of Translation Medicine and Director of the Human Immunology Program at the Sidra Medicine Research Branch. He also serves as Adjunct Associate Professor at the Hamad Bin Khalifa University in Doha, Qatar. Dr. Bedognetti joined Sidra in 2014. He received his MD and PhD in Clinical and Experimental Oncology and Hematology from the University of Genoa, Italy. After obtaining the Board Certification in Medical Oncology by the University of Genova and Italian National Cancer Institute (IST) in 2008, he joined the Infectious Disease and Immunogenetics Section (IDIS) of the US National Institutes of Health (NIH) where he completed his post-doctoral fellowship. From 2013 to 2014, he served as Director of the Federation of Clinical Immunology Societies (FOCIS) Center of Excellence at NIH Clinical Center. Dr. Bedognetti is member of the Society for Immunotherapy of Cancer (SITC) Cancer Immune Responsiveness Taskforce, and the FOCIS Centers of Excellence Steering Committee. He is the Editor of the Cancer Microenvironment Section of the Journal of Translational Medicine (Springer Nature), and Editorial Board Member of Scientific Reports (Nature Research) and Cancer Treatment Reviews (Elsevier).



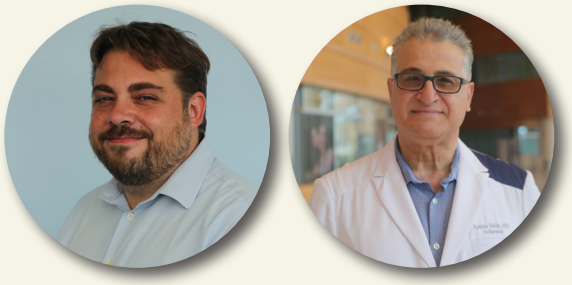
HUMAN IMMUNOLOGY

SCIENTIFIC DIVISION DIRECTOR
Dr. Davide Bedognetti

Dysregulation in the immune system can cause or favor a wide spectrum of human illnesses that are prevalent in women and children, ranging from classical immunemediated diseases (e.g, asthma, autoimmune diseases, and immune deficiencies) to multi-factorial pathologic conditions such as cancer, infections, neurological disorders including autism, complicated pregnancy, and pre-term birth. The availability of therapeutic approaches aiming at reprogramming the immune system are constantly increasing, and with them the need to tailor treatment choices, predict response and manage and/or anticipate adverse events. By studying the immune system, we can improve efficacy of vaccination, repress autoimmunity or reverse conditions such as cancer and infections.

The division is divided in two sections, which are (a) The Allergy, Inflammation and Infectious Disease (AIID) Section, which focuses on infectious disease, inborn errors of immunity, asthma, allergy, and complicated pregnancies, and (b) The Cancer Immunology and Immunotherapy (CII) Section, which focuses on cancers in women and children. The mission of the division is to to develop novel diagnostic approaches and therapeutic strategies to promote and realize the concept of precision medicine in patients affected by diseases caused or facilitated by immunologic dysfunctions. The division will serve as a beacon for the training new generation of translational scientists with knowledge of both basic and clinical aspect of human immunology.

PROGRAM HIGHLIGHT
Breaking The Stereotype



Family holds a significant place as a sacred institution within the Arab culture. In times of distress, such as the news of a child diagnosed with cancer, it is the family that pushes for the best possible treatment for rapid recovery. In Qatar, it has long been the belief that the best treatment for cancer is done abroad but as times are changing so are perceptions.

The division of Pediatric Hematology-Oncology at Sidra Medicine opened in May 2018. It was designed to care for all children and adolescents from birth up to 18 years of age. Sidra Medicine is revolutionizing the medical landscape of Qatar by building infrastructure that allows for state-of-the-art treatments using the best diagnostic tools available while also implementing refined research methodologies.

Dr. Davide Bedognetti- acting Executive Director of Translational Medicine and Director of the Cancer Program- is confident that the organization is internationally competitive and quickly gearing up to meet the standard of care and needs for clinical research. “Here at Sidra Medicine, we have the best pathologists and oncologists for pediatric cancer who have years of experience and are leading members in international committees on different tumors,” said Dr. Bedognetti.

Being a hub for pediatric oncology gives the opportunity to treat every child diagnosed with cancer in Qatar. In the present, the aim is to characterize every single tumor at the deepest level of accuracy using advanced technology. Some patients do not respond to existing traditional cancer drugs and a personalized treatment solution is necessary. This is where research comes in applying advanced diagnostics to propose effective treatments that are otherwise not available as a standard of care.

Dr. Ayman Saleh is the Division Chief of Pediatric Hematology-Oncology. Recently, he has noticed that more patients are seeking treatment for their cancerstricken children at Sidra, rather than travelling abroad.

This is directly related to the expanded services where Sidra Medicine started caring for these severe types of diseases. The oncology clinic is staffed with people from diverse backgrounds sharing their experience and skills to build a multidisciplinary atmosphere for medical innovation. Sidra Medicine is establishing a bone marrow and stem cell transplant service for children in the same age group of newborns to 18 to be provided this service locally. There is also a specialized clinic to prepare and care for patients pre- and posttransplant. The clinic takes care of children within 100 days of their transplantation.

Written by:
Mohammad Wasay

MATERNAL & CHILD HEALTH

SCIENTIFIC DIVISION DIRECTOR
Dr. Souhaila Al Khodor

A woman's health at conception and during pregnancy impacts the well-being of her child. Sidra Medicine's Maternal and Child Health (MCH) division aims to improve women's and children's health by implementing state-of-the-art clinical and translational research. This division focuses on two of the seven priority populations described in the Qatar National Health Strategy. In collaboration with the Obstetrics and Pediatrics clinics, the MCH division aims to address major health problems facing women trying to become pregnant, pregnant women, their growing fetuses, infants, and children up to two years old. The goal of the division is to employ a systems biology approach by combining various omics tools (metagenomics, metatranscriptomics, proteomics, metabolomics, etc.) and non-omics tools such as dietary and lifestyle assessment in order to achieve an integrative view of health and identify signatures associated with the disease.

The Maternal and Child Health division focuses on the following areas:

- Pre-conception health
- Genetics of infertility
- Functional characterization of genes preserving women's reproductive health.
- Prenatal health: healthy pregnancy leading to healthy babies
- Identify novel biomarkers to predict pregnancy complications
- Baby's health: the first one thousand days.

Dr. Al Khodor is the Director of Maternal and Child Health Department in the Research Branch at Sidra Medicine, Qatar, and an Investigator-associate level. Dr. Al Khodor is in charge of the Microbiome and Biomarkers discovery lab. Dr. Al Khodor received her second Master's degree and PhD in Microbiology and Immunology from the University of Louisville, Louisville, KY, USA (2005–2008). Before joining Sidra, Dr. Al Khodor worked in the Signaling systems Unit, laboratory of Systems Biology, at the National Institute of Allergy and infectious Diseases (NIAID), National Institutes of Health (NIH) in Maryland, USA. Dr. Al Khodor is an adjunct Assistant Professor at the College of Health & Life Science in Hamad Bin Khalifa University, and an Adjunct Assistant Professor at the Department of Biomedical Sciences, College of Health Sciences in Qatar University.

PROGRAM HIGHLIGHT

Pregnancy is governed by multiple molecular and cellular processes, which might influence pregnancy health and outcomes. Failure to predict and understand the cause of pregnancy complications, adverse pregnancy outcomes, infant morbidity, and mortality, have limited effective interventions. Integrative multi-omics technologies provide an unbiased platform to explore complex molecular interactions with unprecedented depth.
Qatar has reported high rates of pregnancy complications including gestational hypertension (18.4%), GDM (21%), pre-eclampsia (3.7%), PTB (10%), low birth weight (8.8%), and stillbirth (6.9%). The etiology of these complications is highly variable and remains elusive in the majority of cases. With only one birth cohort in the country, there is a pressing need for more research aiming to identify early biomarkers of pregnancy complications to enable the clinical team to predict and intercept complications in a precise manner.

The MCH division launched the following novel studies:

- "Omouma" which means motherhood in Arabic, and it implicitly explains the aim of the study. In this study, we aim to investigate factors affecting pregnancy outcomes, the early life determinants, and their impact on the infant, child's, and adolescent's health in the population of Qatar.
- NutriWeMan study: nutrition and weight management in woman. The main aim of this project is to compare the efficacy of the diet treatment alone compared to medications on reducing body weight and improving metabolic traits, taking into account the effect of patient's genetic background, gut microbiome and epigenetic determinants.
- PN-ART study: precision nutrition in assisted reproductive technologies. Understanding how the nutritional status and diet profile of women affects their follicular function may open to new pathways to improving the efficacy of ART procedures.
- Genetics of Human Infertility: aims to identify the genes and biological processes underlying fertility disorders of genetic origin with the ultimate goal of providing more precise diagnosis and targeted treatments to couples experiencing infertility in Qatar.

HUMAN GENETICS

SCIENTIFIC DIVISION DIRECTOR
Dr. Khalid Fakhro

The Human Genetics Division at Sidra Medicine Research Branch harbors basic and translational multidisciplinary research in broad areas of genetics, molecular genetics, genomics and bioinformatics, with the goal of enabling the institution's mission to deliver world class tertiary care for women and children. The division's overall strategy is to leverage state of the art techniques in collaboration with local and world experts to drive the precision medicine of a wide spectrum of genetic disorders afflicting the population of Qatar and of the wider Middle East. The mission of the Human Genetics Division at Sidra is to apply multidisciplinary expertise to further our understanding of how human genetic variation impacts health and disease in women and children. It's ultimate goal is to help bring the highest quality of care possible to patients with genetic and genomic disorders, ranging from precise diagnostics and risk profiling to state of the art therapeutics. The division's core contribution is to enable patients access to cutting-edge research not yet implemented at the clinic, having the promise to shedding light on their diseases and bringing hope for new treatment options.

Dr. Khalid Fakhro is the Chief Research Officer and Director of the Precision Medicine Program at Sidra Medicine, the largest tertiary care women and children hospital in Qatar. Dr. Fakhro leads the Laboratory of Genomic Medicine, which focuses on bringing emerging genomic technologies from the lab close to the patient's bedside. Over the past decade, his group has sequenced thousands of genomes from patients and volunteers across the Middle East, leading gene discovery efforts for a wide range of rare disorders, as well as landmark studies on population structure, genome structural variation, and the role of Islamic ethics in genome research. In addition to research and hospital duties, Dr. Fakhro serves multiple leadership roles in Qatar's growing biomedical ecosystem, including as Board Member of the Qatar Precision Medicine Institute, and Adjunct Faculty at both Weill Cornell Medical College and Hamad Bin Khalifa University.

In a large-scale genomic study, Sidra Medicine researchers help unveil cancer susceptibility amongst Arab and Middle Eastern populations

In a large-scale genomic study, Sidra Medicine researchers help unveil cancer susceptibility amongst Arab and Middle Eastern populations Researchers at Sidra Medicine recently coled a study published in Lancet Oncology, describing the differential genetic risk to various cancer types amongst the distinct genetic subgroups of Arab populations, based on more than 6,000 subjects. The study builds on a previous Sidra Medicine-led study that is key to revealing the main genetic ancestries of Arab populations.

Using state-of-the-art bioinformatics and statistical genetics methods, the team analyzed the genomes of 6,142 Qataris provided by Qatar Genome Phase One. This involved the application of polygenic risk scores (PRS) optimized from The Cancer Genome Atlas (TCGA) to assess risk for the most common cancers in the country (breast, prostate and colorectal cancers). In addition, rare genetic variants in 1,218 known cancerrelated genes were assessed for pathogenicity and actionability amongst the various genetic subpopulations of Qatar.

Dr. Davide Bedognetti, acting Executive Director of Translational Medicine and Director of Cancer Program at Sidra Medicine, who co-designed the study and supervised the analysis, said, “This is the first study of its kind in the region. As part of previous work in the TCGA consortium, we established a link between germline and various cancer phenotypes. This study shows that germline cancer risk is real and different in various Arab ancestries. For example, it is lowest for colorectal cancer in Peninsular Arabs and highest amongst Arabs of African origin.

At Sidra Medicine, we are implementing a cancer program for genetic testing, and these results will help drive that forward”.

Dr. Younes Mokrab, co-First author and head of the Medical and Population Genomics Laboratory at Sidra Medicine, said, “We did a thorough investigation of rare nctionallydamaging genetic variants and identified more than 70 subjects carrying ones that are potentially disease-causing. After previously publishing the genetic architecture of Arab populations, the logical next step was to look for founder effect mutations that may be relevant to cancer. We indeed found breast cancer variants were over-represented by Arabs with a West Eurasian/ Persian origin and completely absent in Peninsular Arab Qataris. Conversely, Lynch Syndrome variants were over-represented in Peninsular Arabs.”
The study involved Sidra Medicine, Weill Cornell Medicine-Qatar, and Qatar Computing Research Institute (QCRI). Dr. Khalid Fakhro, Chief Research Officer at Sidra Medicine, noted, “This remarkable national effort facilitates our understanding of the genetic basis of cancer and places Sidra Medicine at the forefront of delivering precision medicine in the region.”

The study was designed as a benchmark for providing genomic medicine solutions in Middle Eastern and Arab cancer patients. It is expected to support efforts in Qatar and the region to increase the effectiveness of preclinical screening and tailored therapy in largely under-studied Arab populations. This work was funded in part by Sidra Medicine, Qatar Genome Program, and Qatar National Research Fund.

CORE FACILITIES

RESEARCH CORE FACILITIES

The Research Core Facilities support Sidra Medicine's mission to deliver Precision Medicine through Precise Diagnostics and Precise Therapeutics, unlocking the potential to leverage new knowledge through translational therapies and technologies intended to advance patients' care and safety through high quality and carefully supervised clinical trials.

The philosophy of the Cores insists on 4 main leitmotivs:

1. Integration: functional crosstalk among the Cores to deliver.
2. Support of strategic program: all Cores' activities revolve around Precision Medicine, ranging from cutting-edge genotyping both in experimental and/or defined clinical settings.
3. Accreditations/Certifications: services in each Core will be developed according to robust international standards ensuring highest quality of results/products, for the benefit of Sidra Medicine's patients. Accreditations/certifications will elevate Sidra Medicine's reputation and increase its market presence along with its commercialization potential.
4. Commercialization: high quality, internationally bench marked services will be adequately promoted for both internal and external customers.

EXECUTIVE DIRECTOR
Dr. Rashid Al-Ali

Dr. Rashid Al-Ali received his Ph.D. in Computer Science from Cardiff University – Wales, the UK in 2005 and his MS in Computer Science from George Washington University – Washington, DC, the USA in 1997. In 1992 Dr. Rashid Al-Ali graduated with a BS in Computer Engineering (with Honours) from the University of the Pacific – California, USA. Dr. Rashid Al-Ali was a Clinical Informatics Research Fellow at the Division of Clinical Informatics, Harvard Medical Faculty Physicians at BIDMC – Harvard Medical School, Boston USA in 2012. Dr. Rashid Al Ali is the Executive Director for Core Facilities and the Director of the Digital Health. The research core facilities consist of four cores: Deep Phenotyping, Advanced Cell Therapy, Integrated Genomics Services, and Digital Health. Dr. Rashid Al-Ali's research experience is in Distributed Systems, Grid Computing, and Clinical Informatics.

DIGITAL HEALTH CORE HIGHLIGHT

Sidra Research Gets Awarded by Microsoft

On August 31st the Ministry of Communications and Technology along with Microsoft held their inaugural award ceremony to celebrate innovation in Qatar for sectors that are using Microsoft cutting edge technology. Sidra Medicine's Research Department was awarded Innovation Excellence in High Performance Computing; the award was collected by Dr Rashid Al Ali our Executive Director of Research Core Facilities and Director of Digital Health Core.

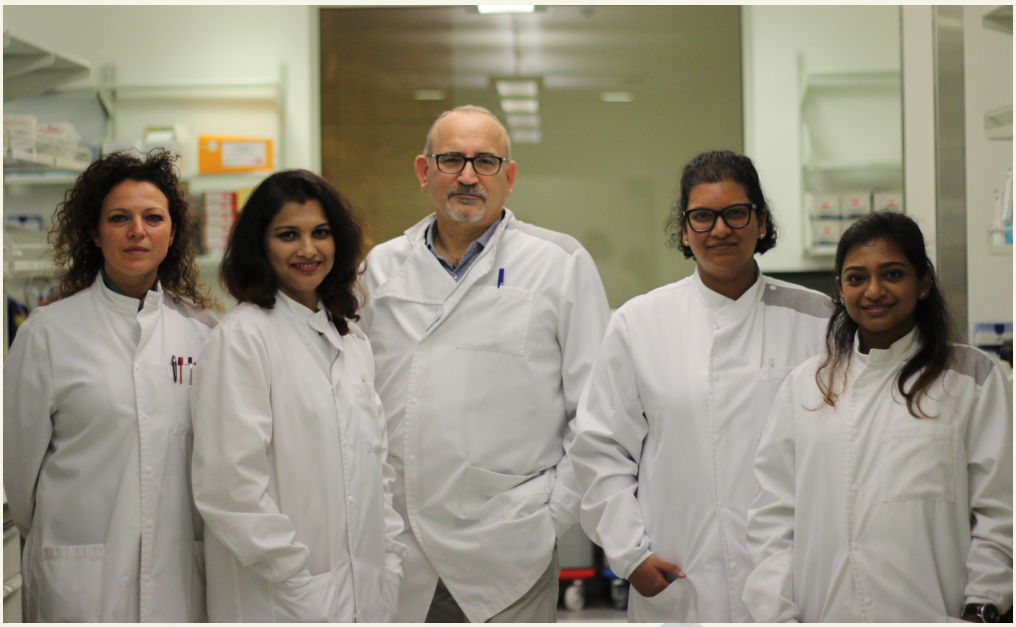
This award positions Sidra Medicine as leaders in research utilizing high performance computing on the cloud and was presented by the Europe, Middle East and Africa Microsoft President and HE the Minister of Telecommunication and Technology, Mr Mohammed bin Ali bin Mohammed Al Mannai.

DEEP PHENOTYPING CORE (DPC)

CORE FACILITY DIRECTOR
Dr. Jean-Charles Grivel

Sidra Medicine is aiming at delivering personalized medicine to the patients of Qatar and beyond. The systematic measurement and analysis of qualitative and quantitative traits of patients, known as Phenomics, completes the personalized medicine approach initiated by genomic approaches. The Deep Phenotypic Core (DPC) provides a multifaceted phenomics platform dedicated to establishing cellular, molecular and functional phenotypes that complement genomics, transcriptomics, and clinical phenotypic analyses of patients. Relying on metabolomics, lipidomics, elemental chemical analysis, high-dimension proteomics, super-resolution microscopy and high-dimension flow cytometry, the DPC generates systematic, high-quality, validated precise molecular and cellular phenotypes of patients and enable true phenomic science in Qatar. The DPC aims at providing in depth and breadth the panels of diagnostic and investigational assays proposed in Sidra and in Qatar. The DPC mission is to provide the technical and intellectual frameworks for the realization of the second pillar of Sidra Medicine's Research Personalized Medicine agenda: "Establishing an Advanced Diagnostics program."

Jean-Charles Grivel obtained his Ph.D. in immunology from the University of Aix Marseille II. He held several positions at the USA National Institutes of Health until joining Sidra in 2015. He pioneered the development of human organ culture for studying the pathogenesis of HIV, Human Herpes Viruses and Measles virus as well as their interactions. Dr. Grivel has developed flow-cytometric methods for characterizing antigenspecific cellular responses as well as microvesicles and viruses. Dr. Grivel has received the NIH Award of Merit in 2006. He has authored 98 peerreviewed publications.



ANALYTICAL CHEMISTRY FACILITY

Comprehensive and accurate characterization of metabolites.

The Analytical Chemistry Facility, managed by Dr. Shana Jacob, serves researchers by complementing scientific investigations with comprehensive and accurate biochemical analysis.
The facility has developed semi-quantitative and quantitative assays for metabolomics, lipidomics, fatty acids, short-chain fatty acids, amino acids, and sphingolipids from a range of sample matrices such as blood plasma, urine, stool, cancer cells, erythrocytes, PBMCs, adipocytes, CAR T-cells, spent media and zebrafish.
The facility works closely with Sidra Medicine investigators and clinicians to provide insights into altered metabolism.
In 2022, more than 303,000 results were produced by the Analytical Chemistry Core Facility.

The predominant sample matrix assayed was human plasma from studies of asthma and obesity amongst children in Qatar, skin cancer, and paediatric allergies to cow's milk. The main techniques applied were metabolomics, lipidomics, and quantitative assays of sphingolipids.
This year a step forward in innovation was made with the receipt of a second binary pump for the liquid chromatography system coupled to the orbitrap Fusion Lumos mass spectrometer. With this instrument configuration, metabolomics and lipidomics can be conducted in the one sample run. Initial testing has demonstrated the semi-quantification of more than 1500 annotated compounds from human plasma.

ADVANCED IMAGING FACILITIES

The Advanced Imaging Core Facility is managed by Abbirami Sathappan. The facility runs several imaging projects in collaboration with the local investigators and the pathology department of Sidra Medicine. The facility has developed specific and unique methods to address several imaging application needs. The facility provides training and consultations to investigators to fully address the imaging needs.
This year, the facility has successfully developed staining and imaging routines to visualize multiple markers in the pediatric tumor microenvironment in pre- and post-chemotherapy sections.

Multi-marker imaging provides additional information, complementing the traditional H&E staining performed in the pathology department. This enables us to visualize and understand the role of immune cells and tumor markers in addressing tumor progression and the efficacy of treatments in our patients. This imaging routine is being streamlined and regularized for all the patient samples recruited for ongoing and future studies.

INTEGRATED GENOMICS SERVICES (IGS)

CORE FACILITY DIRECTOR
Dr. Stephan Lorenz

The Clinical Genomics Lab, Omics, Genomic Data Science, and Zebrafish Core Facilities deliver genomics, molecular biology, and informatics services to researchers across Qatar. The Facilities aim to provide high-quality service and data (i) by ensuring adherence to validated standard procedures, (ii) by ensuring sample integrity and traceability (iii) in a timely fashion with (iv) excellent communication throughout a project's lifecycle. The unique combination of laboratory and analysis services allows IGS to deliver complex scientific projects from the initial screening of large cohorts to follow-up validations using targeted assays to data analysis and experimental follow-up in model systems.
The routine offering of medium-and high-throughput sequencing services are enhanced by 3rd generation genome and transcriptome analysis methods and a state-of-the-art functional genomics Zebrafish Facility. Beyond the routine services, all groups are experienced in method development and always excited to work with our users to deliver novel and innovative approaches to genomics in research and healthcare.

Dr. Lorenz graduated in Biochemistry at the University of Leipzig, where he investigated the role of GPCR kinases in the regulation of GPCR activity. He then joined the laboratory of Prof Ralf Paschke in Leipzig for his PhD, studying calcium-binding proteins and their role in benign thyroid tumours. In 2018, he joined Sidra Medicine as Director of the Integrated Genomics Services, where he uses his background to enable more cost-effective, rapid and robust sequencing solutions, thus supporting important initiatives like the Qatar Precision Medicine Institute, but also enabling the use of cutting-edge sequencing technologies in a clinical setting for diagnostics and Precision Medicine. In this role, he is overseeing the activities of Genomics, Omics as well as the Applied Bioinformatics Core and the Zebrafish Core Facilities, and developing new platforms for largescale biorepositories.

THE CLINICAL GENOMICS LABORATORY (CGL)

The Clinical Genomics Laboratory (CGL), part of the Integrated Genomics Services Core, provides advanced, medium-to high throughput library preparation and sequencing methods using Illumina platforms aiming to deliver the projects with the reduced cost and quicker turnaround time.

In 2022 CGL has validated and optimized whole genome sequencing, RNAseq and single cell sequencing pipelines using the newly installed Novaseq 6000 instruments, which reduced the cost of sequencing by over 50%. More than 14,250 samples have been sequenced during 2022, including over 10,000 whole genome sequencing samples.

Several new protocols were validated: DNA PREP pipeline enabling to process WGS directly from blood, saliva and varying amounts of DNA which enables quick turnaround for urgent samples without shearing.

This pipeline can also be used to process samples for shotgun metagenomics studies.

CGL has installed two Illumina iSeq 100 instruments for library and pooling QC instead of qPCR method. iSeq 100 QC run helps to rebalance library pooling, which improves the evenness of library representation in the NovaSeq sequencing data.

In collaboration with our Pathology Genetics Department, we have validated clinical WES for CAP accreditation and are continuing our work on clinical whole-genome sequencing on order to offer this service to clinicians in Qatar in 2023.

OMICS FACILITY

The Omics Facility, part of the Integrated Genomics Services Core is managed by Dr. Sara Tomei. Omics serves as a centralized facility for national and international researchers, providing access and expertise of leading state-of-the-art technologies for high-throughput genomic, transcriptomic and epigenomic profiling. Its mission is to promote world-class biomedical research by ensuring the availability of the highest quality biospecimens and offering a broad menu of molecular services to meet researchers' needs.
The facility is equipped by an advanced fleet of genomic instruments to provide the following services: manual and automated DNA and RNA isolation, blood fractionation, sample storage, DNA/RNA QC, PacBio long-read sequencing,

Bionano optical mapping, NanoString gene expression profiling, HRM (High-Resolution Melting), Illumina genotyping and methylation arrays, Fluidigm high-throughput qPCR and Applied Biosystems Sanger sequencing. These services complement the genomic sequencing capabilities offered by the CGL.
In addition to the standard services, the Omics Facility team works closely with researchers and technical specialists to implement novel workflows to increase sample throughput and improve processes. The Facility connects interdisciplinary activities and facilitates the process of discovery for the enhancement of scientific breakthroughs.

ZEBRAFISH FACILITY

The Zebrafish Facility joins efforts to treat a rare pediatric disease: This year the Sidra Medicine facility worked with Solve-RD (solving the unsolved rare diseases) to validate a de novo variant in a gene implicated in regulation of natural killer cell effector functions. Dr. Antonio Vitobello group identified the variant at the CHU Dijon in a cohort of three unrelated patients with severe malformation presentations described as Cornelia de Lange-like syndrome. Dr. Sahar Isa Da'as and her group used the zebrafish model to analyze the effects of the genetic variation on skeletal and nervous system development. Ingeniously, the zebrafish model phenocopied the patients' clinical manifestations. Our zebrafish model is currently employed to evaluate possible therapeutic drugs.

The Zebrafish Facility contributes to the Qatar Genome Project (QGP) data interpretations: we work on assessing novel genetic variants related to a rare eye disease, retinitis pigmentosa, that affect retina, causing vision loss. The affected patients have difficulty reading and seeing in poor light or in dark. Our established zebrafish model confirmed the contribution of the QGP-genetic variant to rare eye disease. Zebrafish indicated a decline vision due to reduced eye pigmentation and abnormalities in the retina photoreceptor rods.

ADVANCED CELL THERAPY CORE (ACTC)

CORE FACILITY DIRECTOR
Dr. Chiara Cugno

Dr. Cugno covers the roles of Director of the Advanced Cell Therapy Core and Attending Physician in Pediatric Oncology and Hematology. She is a 20-year experienced medical doctor with a Board Certification in Pediatrics and Pediatric Hematology/ Oncology at the University of Pavia (Italy), and a Master in Pediatric Hematology at the University "La Sapienza," Rome (Italy). At Sidra Medicine, Dr. Cugno has been working on the development of the Advanced Cell Therapy Core, including a Cellular Therapy Unit for the delivery of cellular products for tissue, cell and gene therapy, and a Clinical Trial Office.

The ACTC plays an important bridging function between the Research and Clinical Departments allowing the delivery of personalized, advanced and/or experimental therapies by:

1. Supporting the Hematopoietic Stem Cell Transplantation (HSCT) Program which represents the cornerstone for the majority of other more advanced cell and gene therapy approaches
2. Making Regenerative Medicine, Cell Therapy and Gene Therapy available to patients in Qatar and in the region
3. Providing the management and coordination of clinical trials.

A state-of-the-art GMP facility has been successfully established and will undergo MOPH licensing.
All ACTC personnel who provide clinical services are QCHP licensed, trained in the field of GMP Production and certified by the Association for the Advancement of Blood & Biotherapies (AABB).
Facility and staff are members of the International Society of Cell and Gene Therapy (ISCT).

The ACTC support patients' care for:

- Production of plasma eye drops for children affected by Autosomal Recessive Plasminogen deficiency
- Production of autologous platelet-rich plasma

Services portfolio is being expanded to include:

- Private cord blood banking
- New Regenerative Medicine products/packages in collaboration with Sidra Wellness Center
- Serum Eye Drops as a remedy for one of the most common ocular conditions in Qatar, the "dry eye"
- Clinical grade production and biobanking of Mesenchymal Stromal Cells
- Graft manipulation for HSCT

ACTC is a member of the ISCT and work on a unified QMS in the highly regulated context of the abovementioned activities. ACTC is ISO9001:2015 certified and is planning to undergo ISO 17025:2017, NetCord-FACT and JACIE-FACT accreditations.

CORE HIGHLIGHT
Private Cord Blood Banking

Cord blood (CB) stem cells have been used in the clinic to treat malignant and genetic blood disorders in the last 30 years. Nowadays, CB is being increasingly used for novel applications in the cell and gene therapy and regenerative medicine fields, for the treatment of neurologic diseases, cerebral palsy, hypoxic ischemic encephalopathy, intraventricular hemorrhage, diabetes mellitus, cardiac, vascular, and hepatic diseases.
The setup phase of the processing laboratories for CB Banking has been completed, allowing the storage of more than 2600 CB Units indefinitely.

ACTC is at the forefront of innovation:

- Autologous CB unit is a viable, readily accessible and economic stem cell source for novel personalized approaches of gene therapy, regenerative medicine and tissue engineering.
- The establishment of the first Clinical Grade Repository in the Gulf Region of MSC derived from placenta, for public and private use, will further expand cell therapy weaponry.

ACTC is certified by ISO 9001:2015 for “activities related with processing and quality control of hematopoietic progenitor cells, nucleated cells or mononuclear cells from any hematopoietic tissue (marrow, peripheral blood, umbilical cord) and other tissue sources, collected for therapeutic use; regenerative medicine therapy production, cell therapy bioprocessing of adipose tissue-derived mesenchymal stem cell therapy products for banking and quality product control”.

CLINICAL TRIALS OFFICE (CTO)

The Clinical Trial Office, recently established within the ACTC, is striving to enable both Academic and Pharma-sponsored Clinical Trials with benefits encompassing:

- Strategic value - enhancing Sidra Medicine's image and positioning it on the international stage along with worldwide renowned pediatrics specialist centers for Rare Diseases and Translational Research.
- Public Health value - improving the health outcomes of local community and addressing local and global unmet therapeutic needs by identifying alternatives to limited standard of care treatments.
- Financial value - reducing the economic burden on local and global public health systems, attracting Gulf region and international patients, and preventing medical tourism of local patients. Additionally, partnering with Pharma is expected to generate sustainable revenues which will be invested to ensure additional funding for Research and Innovation.

The CTO serves as a centralized coordinating office for Clinical Research and Clinical Trials aiming at guiding researchers and clinicians through the local regulatory pathway (IRC, IRB, MoPH), and at conducting scientifically and ethically sound human subject research. Through the allocation of Research Coordinators' resources trained in the set-up and conduct of clinical research, the CTO's role and objective are to lead and oversee studies from protocol design to close-out.The CTO supports investigator-initiated and sponsored studies and functions as the point of contact for external sponsors including Contract Research Organizations (CROs) and Pharma
companies.

OFFICE MANAGER
Dr. Antonella Cioce

The Clinical Trials Office is managed by Antonella Cioce. She has worked in basic/ pre-clinical research at Dibit- HSR in Milan and has a PhD in Pharmaceutical Chemistry/Cellular Biology from Kingston University of London, UK. She is a member of the UK RPSGB/GPhC and has led the pharmaceutical set-up of over 100 paediatric CTs in Rare Diseases at Great Ormond Street Paediatric Hospital, London, UK. She is studying towards MSc in Global Health Policy at the LSHTM.

RESEARCH OPERATIONS & SERVICES

Our mission is to offer a “one-stop-shop” approach and solution-oriented admin service to researchers and clinicians. We help establish good laboratory practice, agile and fit-for-purpose processes, and high standards for managing research in a compliant manner. Our main administrative functions are as follows:

- The Project Management Office serves as a central repository and enabling service for research studies.
- The Laboratories & Biosafety Office ensures labs are in good working condition and practices safe.
- The Grants Office manages external and internal competitive awards.
- The Business Office handles budgets, financial reporting and procurement matters.
- The Outcomes & Reporting Office looks after strategic reporting, communications and outreach.
- The Governance & Compliance Office governs the conduct of all research and ensures compliance to relevant regulations and standards.
- The Research Contracts Office manages collaborations and other research agreements.

As a group we are the primary interface and facilitators between scientists and internal/external parties, the innovation office identifies, protects and commercializes novel discoveries and inventions.

CORE FACILITY DIRECTOR
Dr. Max Renault

Max Renault, PhD, leads the Research Operations and Services Core. Dr. Renault has a background in Engineering and has extensive expertise in project/program Management, R&D, New Product Development, Operations Management,
Business Development and Technology Commercialization. Dr. Renault has worked in Europe, Far East and Middle East in the fields of Telecommunications, Manufacturing, Aerospace/Defense, Formula One and Biomedical Research. His research interests lie in teams, adaptation, emotions, crises, and organizational behavior.

Precision Diagnosis and Therapy for Children with Epilepsy

With 14 February marked as International Epilepsy Day, pioneering efforts by Sidra Medicine are gearing towards bringing cure and better management for pediatric patients with epilepsy.

In a recent epidemiologic study completed at Sidra Medicine, up to 60 percent of children with epilepsy were found to have an unknown cause for their condition and these children were more likely to develop drug-resistant epilepsy and exhibit other neurodevelopmental disorders. To improve health outcomes for such children, our team of clinicians and researchers have begun bridging the gap between scientific research and clinical care to identify the underlying genetic causes and aid the diagnosis of the affected patients. The program is being led by Dr. Younes Mokrab, Principal Investigator and Head of Medical and Population Genomics Laboratory and Dr. Ruba Benini, and supported by Ms. Zenab Siddig, Research Assistant.

The same epilepsy study from Sidra Medicine showed that up to 47 percent of children with epilepsy have neurodevelopmental co-morbidities, including but not limited to developmental delays, intellectual impairment, autism spectrum disorders, and learning difficulties.

Over the past few years, Sidra Medicine has implemented precision-based treatment and therapy through collaboration between scientific research and clinical diagnosis. The approach has been successfully applied to epilepsy, whereby neurologists, pediatricians, radiologists and neuro-surgeons have been working closely alongside researchers locally within Qatar and internationally to deliver the best care - from bedside to bench and back again. This has contributed to the building of a personalized medicine program by providing individualized treatment plans suitable for each patient.

A Race Against Time

An hourglass can offer the right symbolism for the worldwide phenomenon that is cancer- a disease where time is of utmost importance. In children, some cancer cells can double in one day, so outcome is dependent on timely intervention and correct diagnosis. There are lives that hang in the balance where every hour that passes constraints the window of opportunity for effective medical response. In such a quagmire, personalized medicine may offer alternatives once thought to be unrealistic.

Dr. Chiara Cugno, director for the Advanced Cell Therapy Core at Sidra Medicine, is a pediatric oncologist and hematologist serving a dual role as both researcher and clinician. Her patient pool consists of pediatric cancer patients from all over Qatar that are referred to Sidra as the only third-level center for pediatric cancer in the country, covering treatment, diagnosis, and follow up. Dr. Cugno holds specific expertise in pediatric leukemia and hematopoietic stem cell transplantation and is a firm believer in advanced diagnostics and treatments as part of personalized medicine.

Genetic sequencing, a method to determine the entire genetic makeup of the cells, holds the promise to help treat and cure cancer patients. It underscores the importance of strengthening the relationship between both sides of medicine: the research and clinical. “Sequencing can allow to unveil tumor-specific mutations that can guide the applications of targeted treatments. The clinical question that we have to answer is important, otherwise the researcher would venture blindly,” says Dr. Cugno.

Sidra Medicine is an internationally competitive organization and is proactive in the global fight against cancer where people like Dr. Chiara Cugno are leading the offensive. Personalized approaches are necessary weapons in the artillery for cancer treatment and can potentially provide more scientific breakthroughs in the future.

Written by:
Mohamad Wassay

RESEARCH PRINCIPAL INVESTIGATORS

Dr. Ammira Akil
Precision Prevention of Diabetes, Obesity and Cancer

Dr. Akil is a Principal Investigator Assistant level in human genetics program and the group leader of translational genomics of diabetes research team at Sidra Medicine research department. Dr. Akil has MSc in molecular Immunology, GC-LTHE1, Graduate Certificate in Learning and Teaching (Higher Education), PhD in molecular genetics from university of New South Wales, Australia. Dr. Akil earned an International Executive MBA from HEC-Paris business school focusing on “innovative management and Entrepreneurial leadership” .

During her career, Dr. Akil was a finalist at the Inventor of the year award and filed one Australian provisional patent application with the New South Innovations, Australia. She has also received several prestigious national and international recognition awards. Dr. Akil scientific, organizational and communication skills, leadership, and management expertise in the field of clinical research placed her as the right person to found and chair the CUDOS nationally and internationally recognized scientific and educational series.

Dr. Annalisa Terranegra
Laboratory of Precision Nutrition

Dr. Terranegra is a Principal Investigator Assistant level in the laboratory of Precision Nutrition. She obtained her MSc degree in Biological Sciences cum laudae in 2000 at the University of Siena, Italy, PhD in Molecular Medicine in 2007 at the University of Milan, Italy and Post-graduate Diploma cum laudae in Nutritional Sciences at the University of Milan, Italy in 2015. Dr. Terranegra also has extensive teaching experience as Assistant Professor in Nephrology (2007-2010) and in Dietetic Sciences and Technologies (2010-2013) at University of Milan, Italy.

She was also lecturer in Molecular Medicine PhD course (2009-2011) at University of Milan, Italy. Dr. Terranegra currently covers the position of adjunct Assistant Professor, since 2015, in the college of Health and Life Sciences at Hamad bin Khalifa University, Qatar and adjunct Assistant Professor, since 2018, in the College of Health Sciences at Qatar University, Qatar.

Dr. Bernice Lo
Laboratory of Immunoregulation

Dr. Bernice Lo is a Principal Investigator Assistant level in Genetics program at Sidra Medicine and an Adjunct Assistant Professor at Hamad bin Khalifa University (Doha, Qatar). She has contributed to the discovery, diagnosis, and molecular understanding of inherited autoimmune disorders. Bernice performed her post-doctoral training under the leadership of Dr. Michael Lenardo in the Laboratory of Immunology at the National Institutes of Health in the US.

She is trained in cell and molecular biology and genomic approaches for genetic diagnosis. During her fellowship, she helped discover and understand the etiology of two new diseases of immune dysregulation. She received her Ph.D. in Cell Biology at Duke University under the mentorship of Dr. Jo Rae Wright, where she began her appreciation for the immune system and the critical role of immune tolerance and regulation.

Dr. Cristina Maccalli
Laboratory of Immune Biological Therapy

Dr. Cristina Maccalli is a Principal Investigator Assistant level in the laboratory of Immune Biological Therapy expertise is in the field of immunology, tumor immunology and immunotherapy. She obtained a Ph.D. in Applied Genetics at the University of Milan, Italy. She has carried out her post-doctoral research programs at the National Cancer Institute in Milan, Italy and, then, as visiting fellow at the Surgery Branch, National Cancer Institute, NIH, Bethesda, MD, USA.
In October 2013 she contributed to the development of the Laboratory of the Italian Network of Biotherapy of Tumors (NIBIT)/University Hospital of Siena, Italy dedicated to ImmunOncology (IO) studies and the immunomonitoring of patients undergoing immunotherapy treatments. In October 2015 she joined the Research Department at Sidra Medicine. She is the Editor of the section of Translational Cancer Biology of JTM and of the Section Immune Response of Advances in Cancer Biology-Metastasis (Elsevier).

Dr. Matteo A Avella
Laboratory of Reproductive Biology

Dr. Avella is a Principal Investigator Assistant level in the Laboratory of Fetal and Placental Biology. Prior to joining Sidra Medicine, Dr. Avella was an Assistant Professor in the Department of Biological Science at the University of Tulsa (Tulsa, OK, USA) and the School of Health Professions at Eastern Virginia Medical School (Norfolk, VA, USA). Dr. Avella received his B.A. in Biology from the University of Milan, Bicocca (Italy). He then completed a Ph.D. at the Polytechnic University of Marche (Ancona, Italy), studying the intestinal microbiota's effects on fish's early development and reproduction.

He conducted postdoctoral research at the National Institutes of Health (Bethesda, USA), where he switched his studies to the mammalian system and focused his research efforts on understanding the molecular mechanisms regulating fertilization in mice and humans. Before his first academic appointment at the University of Tulsa, Dr. Avella received training as a human embryologist at Shady Grove Fertility (Chesterbrook, PA, USA).

Dr. Nicholas van Panhuys
Laboratory of Immunoregulation

Dr. van Panhuys is a Principal Investigator Assistant level in the Laboratory of Immunoregulation. He completed his BSc in Biochemistry and Molecular Biology, Cell and Developmental Biology at Victoria University (New Zealand). Following this, completed the Honors program in Molecular Biosciences at Victoria University. Before being awarded Rex and Betty Coker Post Graduate Scholarship to conduct his PhD studies at the Malaghan Institute for Medical Research (New Zealand) where he investigated the role of IL4 and STAT6 in protective immunity and T helper 2 immune responses. He was then awarded the NZ Foundation for Research Science and Technology post-doctoral fellowship award, to work as a visiting fellow at the National Institutes of Health (Bethesda, USA) in the Laboratory of Immunology with Dr. Ronald Germain. Consequently he was appointed as a research fellow in the Laboratory of Systems Biology at the NIAD, NIH.

Dr. Luis R Saraiva
Laboratory of Neurometabolism
and Functional Genomics

Dr. Saraiva is a Principal Investigator Associate level in the Laboratory of Neurometabolism. He completed a Licenciatura (BSc+MSc) in Biology at the University of Evora (Portugal). After, he became a Fellow of the International Graduate School in Genetics and Functional Genomics of the University of Cologne (Germany), where he received his PhD in Genetics (summa cum laude). After a brief period as a visiting scientist at Harvard Medical School in Boston (USA), he worked as a postdoctoral scholar in the lab of Linda Buck (Nobel Laureate in Physiology and Medicine 2004) at the Fred Hutchinson Cancer Research Center in Seattle (USA).

As he became an EBI–Sanger Postdoctoral (ESPOD) Fellow, he moved to Cambridge (UK), where he continued his postdoctoral training at the EMBL-EBI and the Wellcome Sanger Institute. Since October 2015, he is a Principal Investigator at the research branch of Sidra Medicine. Additionally, he is an Adjunct Faculty Member at the Monell Chemical Senses Center (Philadelphia, USA) and at Hamad bin Khalifa University (Doha, Qatar).

Dr. Wouter Hendrickx
Pediatric Cancer Omics Laboratory

Dr. Wouter Hendrickx is a Principal Investigator Assistant level in the Laboratory of Pediatric Cancer Omics in the Human Immunology Division and member of the Cancer Precision Medicine Working Group at Sidra Medicine. He has experience in stem cell and cancer research at the universities of Brussels (VUB), Leuven (KUL) and Norwich (UEA). Where he gained an MSc in biomedical Science (2004) and an MSc Bio-informatics (2005) and a PhD in Medical Science respectively (2012).

At Sidra he has focused since 2014 on the tumor immune micro environment deploying bio-informatic tools to analyze gene-expression data form bulk tumor for immune related signatures and other determinants of the immune phenotype and translating the findings to the wet lab environment. He was a participant of the EU FP6 and PF7 grant framework and is a 2015 QNRF JSREP awardee. Since 2019 he leads Sidra Medicine's efforts in establishing a biorepository for pediatric cancer patients.

Dr. Younes Mokrab
Medical and Population Genomics Lab

The Medical and Population Genomics laboratory at the Sidra Medicine uses advanced genomics and data-centric methods to explore fine-scale population structure of and its impact on disease risk, progression and response to treatment. It has particular interest in Arab and Middle Eastern populations known for high consanguinity. Furthermore, it researches the genetic architecture of neurodevelopmental disorders including the establishment of a national registry and disease cohort. The lab's expertise lies in genomics especially long-read sequencing, data science and biostatistics. It is funded by multiple internal and external grants in collaborations with worldwide institutions including Stanford University, University of Washington, and University College London.

The lab is headed by Dr. Younes Mokrab, a Principal Investigator Associate level. Dr. Mokrab joined from Eli Lilly where he led computational genomics research in Neurogenetics to identify/validate drug targets in neuropsychiatry, working closely with Psychiatric Genomics Consortium (PGC). He obtained a PhD in bioinformatics from Prof. Tom Blundell lab, University of Cambridge, UK (2007), followed by a postdoctoral fellowship from Prof. Mark Sansom Lab, University of Oxford (2010). Upon joining Sidra, Dr. Mokrab helped establish research programs in population and medical genetics and is a co-founding member of the Qatar Genome Program Research Consortium.

International Grant updates: Diabetes and Gene Editing research

Sidra Medicine congratulates Dr. Ammira Akil, Dr. Tawfeg Ben Omran and Dr. Cristina Maccalli on their recent research milestones at Sidra Medicine and being part of two major international grants.

Dr. Ammira Akil, an investigator in diabetes precision medicine is the recipient of two grants from the Juvenile Diabetes Research Foundation (JDRF).

Type 1 diabetes is an autoimmune disease that ultimately results in the destruction of insulin-producing beta cells and a life-long dependence on carefully titrated exogenous insulin. It is estimated that approximately 20 million people globally are affected by type 1 diabetes. JDRF has been leading the fight against type 1 diabetes by funding many leading scientists across the globe to help deliver possible cures and life-improving breakthroughs and have awarded $400,000 in two grants funding to Sidra Medicine.
The first funding will go towards the ALDIAR 1 "Road to prevention" project lead by Dr. Akil as lead Principal Investigator and Dr. Tawfeg Ben Omran, Division Chief of Genetic and Genomic Medicine as Co-PI. The project aims to take an improved combined approach to predict the genetic risk of type 1 Diabetes in the Middle East and North Africa region through scalable and cost-effective technologies.

The second grant (directly with Dr. Akil as lead PI) will look at the early prediction of progression to autoimmunity in Type 1 Diabetes –as an institutional collaboration between Western Sydney University in Australia, the Steno Diabetes Center Copenhagen (Denmark) and Sidra Medicine. Both research projects will help pave the way to enhance predictions of type 1 diabetes among susceptible children through emerging technologies.

The programs reinforce Sidra Medicine's commitment to research with the ultimate goal of a cure and global prevention of type 1 diabetes. Dr. Cristina Maccalli, an investigator in Immune Biology Therapy at Sidra Medicine, has been appointed as Co-principal investigator in the European Cooperation in Science and Technology-COST grant application by the Pfizer-University of Granada-Junta de Andalucía Centre for Genomics and Oncological Research (GENYO) in Spain.

Dr. Maccalli will participate in a major EU funded genome editing research program, involving 18 international partners and worldwide renowned experts in the field. The program will bring together pharmaceutical companies, academic institutions, science and regulatory agencies, biotechnology firms, patient advocacy associations and information technology.

The aim of the program is to tackle knowledge fragmentation and accelerate the translation of genome editing technologies for the treatment of human diseases. The consortium consists of several groups of experts who will work on different aspects of the genome editing technology, from its very basic assessment to safety, specificity and clinical applications to tackle inherited rare diseases, cancer, and infectious diseases.
Dr. Maccali's role as Co-principal investigator would be to implement the ex vivo delivery of genome editing systems and for delivering of innovative protocols to be applied for translational studies for cancer cell therapy.


250 cm³
MSZ

EDUCATION AND CAPACITY BUILDING

FRESH PhD AND MSc GRADUATES

Eman Wehedy,
Mentored by Dr. Souhaila Al-Khodor
PhD in Genomics and Precision Medicine

Geetha Gandhi,
Mentored by Dr. Khalid Fakhro
PhD in Genomics and Precision Medicine

Muhammed Kohailan,
Mentored by Dr. Khalid Fakhro
PhD in Biological and Biomedical Sciences

Shimaa Sherif,
Mentored by Dr. Wouter Hendrickx
PhD in Genomics and Precision Medicine

Sabah Nisar,
Masters in Environmental Science

Sheema Hashem,
Masters in Environmental and Biological Science

CAPACITY BUILDING AT SIDRA MEDICINE

Outreach and education at Sidra Research is paramount, the department hosts several trainees, volunteers and visiting researchers/scientists coming from various universities and institutions, both locally and from around the world.

Sidra Research prides itself as a teaching entity in alignment with the education pillar, one of the three pillars that form the foundation of Sidra Medicine's mission to provide patient care and biomedical research. Training at Sidra encourages young adults to hone their career path in science, medicine and public health. By training under varied professionals and experts, the trainee is provided with invaluable work experience, develops and refines skills and has access to a platform to network with other professionals in the field.

7 VISITING SCIENTISTS:

Chidambaram Manickam, ADLQ
Maryam Al-Nisf, ADLQ
Khadega Ibrahim, QU
Mahmoud Mohamed, HMC
Ayse Nur Ugur, TUBITAK
Farook Al-Ajli, Al Ghannas Qatari Society
Alice Turdo, University of Palemro

62
Externs and volunteers enrolled in 2022

9
PhD students

39
Students from local universities; including Hamad Bin Khalifa University, Qatar University and Northwestern University in Qatar

STUDENT TESTIMONIALS

Saadya Amrullah,
MSc trainee with Ammira Akil

I participated in the externship program with Dr. Ammira after graduating with my Bachelor's degree in Biological Sciences from Qatar University. This six-month journey was exceptionally fascinating and beneficial to my career. Besides developing myself in the lab work and experiments, I utilized the opportunity provided by Dr. Ammira to enhance my scientific writing skills and develop critical thinking. Some of the lab skills I learned included bacterial transformation, reverse and forward transfections of HEK293 cells, western blot, qPCR, PBMC isolation, and immunofluorescence staining of cells. I was also presented with challenging writing tasks, such as peer-review of two non-published articles and an currently involved in a highprofile study design. I am grateful to Allah, my family and Dr. Ammira, who facilitated this journey and gave me a chance to realize my potential and invest in my career as a researcher.

Farhia Abdullahi,
Biological Sciences trainee with Davide Bedognetti

Working in the field of Cancer has been my ambition and desire since I my undergrad days. With a degree in Biological Sciences from Qatar University, I seized the opportunity to train in the field of cancer research with Dr. Davide Bedognetti's team at Sidra Medicine. This opportunity has been an eye opener to me. I underwent extensive hands-on training on several complex research tools and performed extensive immunofluorescence protocols on FFPE sections and Laser Scanning Confocal Microscope. I also received hands-on training on the latest technology available in the Middle East, GeoMx from Nanostring, a spatial and molecular analysis platform to understand the molecular differences in tumor vs healthy tissue in tumor tissue sections. I prepared presentations, examined scientific papers, and acquired knowledge on different topics. This whole experience has increased my confidence and got me thrilled to continue my work in this field.

Shimaa Mohammed Sherif Khedr,
PhD Student with Wouter Hendrickx

I was lucky to have had the opportunity to complete my PhD work at Sidra Medicine under the supervision of Dr. Wouter Hendrickx and Dr. Davide Bedognetti in the Department of Cancer Immunology. I learned different bioinformatics and computational biology skills including the processing and analysis of next-generation sequencing data. Integrated omics are essential for precision medicine in the pediatric oncology field. I was strongly encouraged to participate in numerous international competitions and conferences and had my work shared with the larger scientific community through high-impact publications. I really appreciate what I have learned at Sidra Medicine and am happy to express my experience as fruitful, productive, and memorable. I successfully defended my PhD thesis in March 2022 and started my postdoctoral studies at Sidra Medicine in September 2022 in the Cancer Immunogenomics lab.

Randa Al-Yafei,
PhD Student with Nico Marr

I'm Randa Al-Yafei a PhD candidate in genomic and precision medicine program from Hamad Bin Khalifa University. I joined Systems Immunology and Immune Deficiency research department in Sidra Medicine to work on my thesis "In-depth functional genomic studies of rare patients with life threatening infections and novel inborn errors of immunity". During my journey in Sidra, I obtained an accurate picture of the genomic technologies like Next Generation Sequencing that are used to study the monogenic mutations underlie the inborn errors of immunity (IEI) in pediatric patients. Also, Sidra Medicine helped me to learn several skills and assays to confirm causal relationships between the candidate genotypes and the associated clinical phenotypes in the patients. I hope that my study in Sidra could shed fundamentally new light into the genetic basis of childhood IEI at both the patient and population levels.

Sidra Aftab,
MSc Student with Dr. Annalisa

It has been a wonderful learning experience with Sidra Medicine. I acquired new lab skills and explored novel techniques in Next Generation Sequencing. With constant support, appreciation and recognition from team members, I have been able to identify my true potential as a researcher. I was accorded with an absolutely amazing chance to work on a research project which was a part of an internationally funded clinical trial. This role did not only enhance my competency as a researcher but also provoked a profound interest in genetics and nutrition. The research project has challenged my limits and I am certain that I will rise to the challenge with the support I have been provided. I am truly elated to be a part of Nutrigenomics team led by Dr. Annalisa Terranegra at Sidra Medicine.

Abdulrahman Al-Subaiey,
PhD Student with Bernice Lo

The past 4 years at Sidra Medicine have fully equipped me to be an independent scientist as I was nurtured in the world-class lab of Dr. Bernice Lo, under the exemplary mentorship of Dr. Rafah Mackeh. I have been exposed to all the makings of a scientist from critical thinking, developing my own hypothesis, designing experiments, overcoming obstacles, and coherently presenting my findings to the public. What makes Sidra Medicine special is the collaboration between the research team and the clinic, which tremendously empowered my research. I had the opportunity to do my PhD anywhere in the world, but I specifically chose Sidra Medicine because I wanted to work on poorly studied diseases that were relevant to my country. Overall, Sidra Medicine is an excellent hub for scientists that are interested in cutting-edge precision medicine, and I would highly recommend students to join the externship program to grow into independent researchers.

GRADUATE ASSOCIATE

Sara Al Marzooqi

After a year at Sidra Medicine rotating as a Graduate Associate in the Research Branch, I am happy to view it as the beginning of a challenging yet rewarding journey. I explored many aspects of research and gained experience in different topics such as microbiome, cancer, and obesity. It was a great way for me to decide which path I want to pursue. I was invited to take an active role in various projects. Currently I am leading the FTO project which links obesity to colorectal cancer under the supervision of Dr. Ajaz and Dr. Ammira. I am also in the process of writing two review papers which should be published before the end of 2022. These are major milestones achieved in a short period of time where I have gained immense knowledge and experience. It would have not been possible without the encouragement and support of my line manager and the Sidra family spirit. I have always been interested in medical genetics and genetic counseling and was granted full support to explore this further in collaboration with Sidra Medicine clinicians. I am really proud of my accomplishments so far, and very thankful for the support and guidance I have received.

GRANTS AND COLLABORATIONS

GRANTS AND COLLABORATIONS

15 total grants from Qatar National Research Fund (QNRF) and other external funds were awarded in the last 18 months

Totaling QR 10.99 M

BREAKDOWN OF GRANT APPLICATIONS IN THE LAST 18 MONTHS

Grant Applications	Submitted	Awarded
National Priorities Research Program (NPRP-14S)	7	1
NPRP - Blue Skies Research Award (NPRP-BSRA01)	3	1
Path towards Precision Medicine Call (PPM 05)	8	2
Equine Research Call	1	0
Rapid Response Call (RRC) COVID-19 cycle 2	1	0
Graduate Sponsorship Research Award (GSRA8+)	2	1
Graduate Sponsorship Research Award (GSRA9)	2	1
Postdoctoral Research Award (PDRA7)	3	2
High School Research Experience Program (HSREP4)	1	tba
Conference and Workshop Sponsorship Program (CWSP21)	2	1
Conference and Workshop Sponsorship Program (CWSP22)	1	0
Researchers Exchange and Mobility Program (REMP3)	2	1
SOLVE-RD		
JDRF: Strategic Research Agreement	2	1
Collab with Progreso y Salud Foundation	1	1

Grant Applications	Submitted	Awarded
JDRF: Dr Ammira as co-PI	1	1
Gulf Strategy Fund 2022 - Precision Medicine	1	1
Genome Assembly Grants	1	1
Global Grants for Gut Health	1	0
CONquer canCER Now	1	0
2022 CDKL5 Program of Excellence	1	0
Young Scientist Research Grant	1	0
Helmsley Charitable Trust	1	0
Pablove Seed Grant Program	1	0
JDRF: Career Development Awards	1	tba
Cystic Fibrosis Foundation Grant	1	tba
Pfizer Global Medical Grants	1	tba
Waterloo Foundation	1	tba
JDRF Strategic Research Agreement (SRA) 2023	1	tba
Biocodex Microbiota Foundation	1	tba

INTERNAL RESEARCH FUND WINNERS ANNOUNCED

Sidra Medicine has a dedicated mission to deliver Precision Medicine by fostering efficient therapies and better preventative strategies for human diseases, to enhance human health and well-being, and ultimately support the development of a personalized health care system.

In this regard, the primary purpose of Internal Research Fund 2022 (IRF 22) program is to support competitive and innovative research program initiatives that improve the patient outcomes derived by early detection, better prevention, improving diagnostics, and treatments to all. Consequently, IRF22 also provided funds for activities that may lead to the development and submission of competitive research proposals to an external agency (e.g., QNRF and others). Special attention was targeted to disorders that are prevalent in Qatar and that affect Sidra Medicine's patients. These included, but were not limited to, congenital disorders, diabetes and its complications, mental and neurological disorders, cancer and cardiovascular disease, maternal and child health illnesses, and immunological disorders. Applications were required to be translational and outcome-driven; where clinical outcome improvements would be possible to measure and enabled by Precisions Medicine approaches.

The Internal Research Council (IRC) made the final decision to award the top projects based on a stringent review by international peer-reviewers and overall budget availability over the duration of the studies (mid-2022 to mid-2024). In total, 9 projects were awarded out of 25 applications. Nevertheless, many high-quality applications were received during this cycle and hence we would like to thank everyone who participated.

LPI	co-LPI	Project Title
Dr Ammira Akil	Dr. Tawfeg Ben Omran	ASPIRE COHORT OF NEWBORNS – Advancing newborn Screening Program to Identify babies at high Risk of future disorders for Effective Monitoring and Personalized Care
Dr. Wesam Al-Masri	Dr. Bernice Lo	Elucidating New Genes Involved in Progressive Familial Intrahepatic Cholestasis
Dr. Davide Bedognetti	Dr Ata Ur Maaz	Implementation of Spatially Resolved Transcriptomics in Pediatric Brain Tumors: Toward Advanced Diagnostics Enabling Precision Immunotherapeutic Approaches
Dr. Wouter Hendrickx	Dr. William Mifsud	Pediatric Solid Tumor Heterogeneity and Clinical Impact by Multi-Regional NGS @ Sidra Medicine
Dr. Mohammed Yousuf Karim	Dr. Bernice Lo	The Study of Immunodeficiency after Rituximab in Autoimmunity ("SIDRA") Project
Dr. Arun Lakshmanan	Dr. Goran Petrovski	Fecal mRNAs Role on the Increased Abundance of AKKERMANSIA – A Possible Microbial Marker for Poor Glycemic Control in Qatari Pediatric Type 1 Diabetic Subjects
Dr. Bernice Lo	Dr. Amel Hassan	Biomarker Discovery for Immunomonitoring of Autoimmunity due to CTLA4 Insufficiency
Dr. Rafah Mackeh	Dr. Mamoun Elawad	Targeting Autophagy for a Personalized Treatment in Patients with Inflammatory Bowel Disease
Dr. Younes Mokrab	Dr Ruba Benini	A Multidisciplinary Program to Enable Precision Medicine of Child Epilepsy and Neuro-developmental Co-morbidities in Qatar

TOP TEN ORIGINAL PUBLICATIONS

1 Genetic predisposition to cancer across people of different ancestries in Qatar: a population-based, cohort study

AUTHORS
Younes Mokrab, Rozaimi Razali, Najeeb Syed, Davide Bedognetti

JOURNAL
LANCET ONCOLOGY

2 Fasting-Mimicking Diet Is Safe and Reshapes Metabolism and Antitumor Immunity in Patients with Cancer

AUTHORS
Darawan Rinchai, Davide Bedognetti

JOURNAL
CANCER DISCOVERY

3 Congenital iRHOM2 deficiency causes ADAM17 dysfunction and environmentally directed immunodysregulatory disease

AUTHORS
Ahmad Al-Shaibi, Adrian K Charles, Melanie Makhlouf, Eman H AbouMoussa, Reem Hasnah, Luis R Saraiva, Bernice Lo

JOURNAL
NATURE IMMUNOLOGY

4 The immune landscape of solid pediatric tumors

AUTHORS
Shimaa Sherif, Jessica Roelands, William Mifsud, Eiman I Ahmed, Christophe M Raynaud, Darawan Rinchai 2Abbirami Sathappan, Ata Maaz, Ayman Saleh, Erdener Ozer, Khalid A Fakhro, Davide Bedognetti, Wouter R L Hendrickx

JOURNAL
JOURNAL OF EXPERIMENTAL & CLINICAL CANCER

5 Genome sequencing data analysis for rare disease gene discovery

AUTHORS
Umm-Kulthum Ismail Umlai, Dhinoth Kumar Bangarusamy, Puthen Veettil Jithesh

JOURNAL
BRIEFINGS IN BIOINFORMATICS

6 A 3D transcriptomics atlas of the mouse nose sheds light on the anatomical logic of smell

AUTHORS
Eman Abou Moussa, Melanie Makhlouf, Lisa S Mathew, Li Wang, Susie S Y Huang, Stephan Lorenz, Luis R Saraiva

JOURNAL
CELL REPORTS

7 Human leukocyte antigen class II gene diversity tunes antibody repertoires to common pathogens

AUTHORS
Taushif Khan, Mahbuba Rahman, Ikhlak Ahmed, Fatima Al Ali, Puthen Veettil Jithesh, Nico Marr

JOURNAL
FRONTIERS IN IMMUNOLOGY

8 Nomograms of human hippocampal volume shifted by polygenic scores

AUTHORS
Mohammed Janahi, Younes Mokrab

JOURNAL
eLIFE

9 Immune-related 3-lncRNA signature with prognostic connotation in a multi-cancer setting

AUTHORS
Shimaa Sherif, Jessica Roelands, Sathiya Narayanan, Davide Bedognetti, Wouter Hendrickx

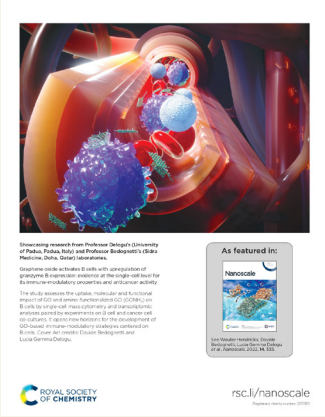
JOURNAL
JOURNAL OF TRANSLATIONAL

10 Identification of Prognostic Metabolomic Biomarkers at the Interface of Mortality and Morbidity in PreExisting TB Cases Infected With SARS-CoV-2

AUTHORS
Ilhame Diboun

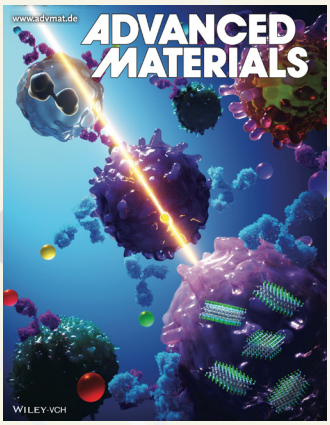
JOURNAL
FRONTIERS IN CELLULAR AND INFECTION MICROBIOLOGY

SIDRA MEDICINE PUBLICATIONS ON JOURNAL COVERS



Graphene Oxide Activates B Cells with Upregulation of Granzyme B Expression: Evidence at the SingleCell Level for its Immune-Modulatory Properties and Anticancer Activity
Laura Fusco, Darawan Rinchai, Wouter Hendrickx, Davide Bedognetti made Jornal cover to **NANOSCALE** in Janauary 2022, Page 207 to 548

Genetic Predisposition to Cancer across People of Different Ancestries in Qatar: a Population-Based, Cohort Study
Younes Mokrab, Rozaimi Razali, Najeeb Syed, Davide Bedognetti made Jornal cover to **THE LANCET ONCOLOGY** in March 2022, Vol 23, Issue 3



Immune Profiling and Multiplexed Label-Free Detection of 2D MXenes by Mass Cytometry and High-Dimensional Imaging
Laura Fusco, Darawan Rinchai, Eiman Ahmed, Jean-Charles Grivel, Davide Bedognetti made Jornal cover to **ADVANCED MATERIALS** in November 2022, Vol 34, No. 45

Research Study Indicates Fasting as New Immunotherapy for Treating Cancer

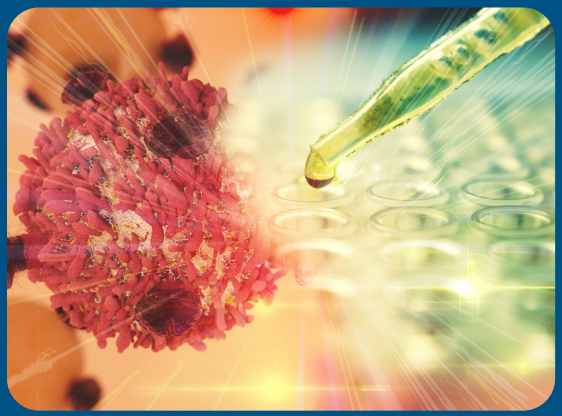
Just in time to mark World Cancer Day on 4th of February, our researchers have collaborated with Fondazione IRCCS, Istituto Nazionale Tumori (INT), Milan, Italy and published a study highlighting the benefits of a fastingmimicking diet (FMD) in helping boost the immune system in cancer patients.
The in-depth analysis of peripheral blood and cancer specimens assessed the biological effects of a fasting-mimicking diet in patients enrolled in clinical trials including the first-inhuman trial. FMD is an approach to fasting that "tricks" the body into thinking it is fasting while allowing minimal food intake.
The findings showed that cyclic FMD was not only safe but also well tolerated and can cause remarkable systemic metabolic and immunological changes in patients with different tumor types. The patients were either undergoing FMD alone or in addition to anti-tumor therapies.

Participants were given a plant-derived, lowcarbohydrate, low-protein diet, amounting to 1,800 kilocalories over five days. The short course of this fasting-mimicking diet resulted in a consistent decrease in blood glucose and growth factor concentration, mirroring the metabolic changes observed in pre-clinical trials.

Dr. Davide Bedognetti, Director of Human Immunology and Cancer ProgramDr. Davide Bedognetti, Director of Human Immunology and Cancer Program and co-senior author of the study, who performed and supervised the immunogenomic analyses of the samples said: "What was remarkable is that after only five days of following a FMD, and without any chemotherapy or immunotherapy, we could see dramatic changes in the gene expression profile of the tumor. The tumors became inflamed and infiltrated by specific immune cells (T lymphocytes) that exhibit tumor-killing capacities.

"We anticipate that FMDs can become part of the treatment regimen for cancer patients, once randomized clinical trials will confirm its efficacy in combination with standard treatment. We also believe that this methodology would be widely accepted in this part of the world, considering the importance of fasting by Muslims during the holy month of Ramadan," continued Dr. Bedognetti.

Published in Cancer Discovery, the flagship journal of the American Association for Cancer Research, the study titled Fasting-Mimicking Diet Is Safe and Reshapes Antitumor Immunity in Patients with Cancer offers clinicians an opportunity to implement new therapeutic approaches to patient treatment.
Dr. Khalid Fakhro, Chief Research Officer said: "In this part of the world, we are very familiar with the myriad benefits of fasting on human health. This world-class study demonstrates yet another remarkable effect as it relates to patients suffering from cancer, where a fasting-like diet was actually shown to impact the immune system on a molecular level, effectively enhancing the body's natural response to tumors. We are proud of such discoveries made by our scientists in supporting global collaborative efforts to develop strategies for the prevention and treatment of cancer– a disease that kills over 10 million people every year."



Sidra Medicine Publishes Groundbreaking study on Pediatric Cancer Tumors

Researchers from Human Immunology in collaboration with the Anatomic Pathology and Oncology Divisions at Sidra Medicine have published a ground-breaking study on pediatric cancer tumors1.

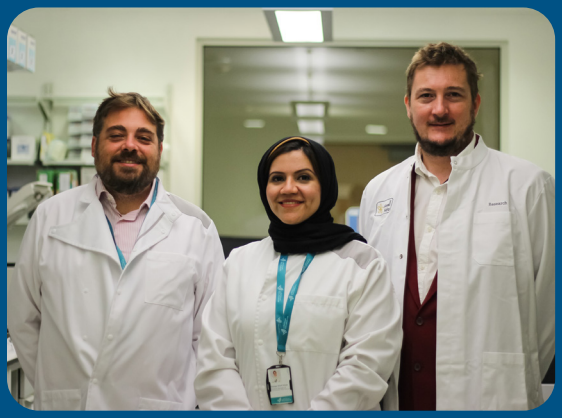
The study analyzed the relationship between tumor cells and immune cells and the impact of anti-tumor immune responses related to the survival of young cancer patients. It was led by Shimaa Sherif (first author) as part of her PhD thesis, who was supervised by Dr. Wouter Hendrickx and Dr. Davide Bedognetti from Sidra Medicine and Dr. Borbala Mifsud from Hamad Bin Khalifa University.

Using the advanced gene expression analysis skills available at Sidra Medicine's research branch, the group implemented methods and algorithms to quantify anti-tumor immune responses. Gene expression analysis, is a technique that allows to quantify the expression of about 20000 genes in a single tumor biopsy. These genes are then analyzed to quantify the intensity of immune reactions. The study found that:

1. Pediatric solid tumors can be divided into six different types according to their immunological parameters, called "immune subtypes".
2. Different immune subtypes are associated with distinct risk of death.
3. An immune signature developed at Sidra Medicine, called immunologic constant of rejection (ICR), accurately predicted the risk of death in patients with certain aggressive tumors such as a subtype of neuroblastoma, one of the most aggressive pediatric cancers.
4. Specific immune markers associated with unfavorable prognosis were also identified, which could be explored as targets for novel immunotherapeutic approaches.
5. Knowing the risks associated with the different immune sub-types could be used to decide the intensity and type of systemic treatment for each patient

Dr. Wouter Hendrix, Principal Investigator from Sidra Medicine's Laboratory of Pediatric Cancer Omics who was the leading senior author of the study said: "Our study also suggests that the quantification of the immune cells and their function in the tumor could be used as an advanced diagnostics tool to estimate the risk of relapse and death and therefore to guide treatment choice. It is taking a precision medicine approach to pediatric cancer treatment."

Dr. Davide Bedognetti, Executive Director of Translational Medicine Department, and Director of the Human Immunology Division, who is leading Sidra Medicine's cancer immunology research said: "This is a timely research particularly coming out to coincide with Childhood Cancer Awareness Month which falls every year in September and highlights Sidra Medicine's continuing commitment to precision medicine and cancer research



EVENTS/ HIGHLIGHTS

Smart City Expo Doha 2022

The city of Doha was the host of the leading event on smart cities and urban solutions under the slogan “Safe, Smart Cities”. The summit addressed issues related to the development of cities and sustainability such as transport, infrastructure and public spaces: and dealt with aspects related to technology and security such as Big Data, blockchain, privacy, regulations, cybersecurity and data protection.

Sidra Medicine was on board in 2022’s Smart City Expo in March 2022, the global platform dedicated to discussing, tackling and solving the challenges facing the cities.

Women in Science Symposium
“Women in Science: The Journey Toward Precision Medicine”

Women are leading the way in groundbreaking research all over the world. Despite their remarkable discoveries, women continue to account for only about 33.3 percent of global researchers, and the make up a minority of senior research position globally. Women have also received less than 4% Nobel Prizes in science.
Over the past decade, the global community has made a lot of effort in inspiring and engaging women and girls to consider careers in science. However, much work remains to be done to achieve through gender equality in science.
“Women in Science” symposium was held on the 28th of May, in the auditorium at Sidra Medicine. The event was also live streamed via Microsoft Teams.

Women were part of the conversation that helps inspire and educate the far-reaching benefits of having more women in science.
The CME accredited program of the symposium “Women in Science: The journey to Precision Medicine” included a panel discussion that featured inspiring and renowned local and international female scientist, clinicians and health care professionals who shared their personal scientific journeys, celebrating success and highlighting challenges while motivating women to pursue successful academic and health care careers. We also learnt about the power of mentorship and how those remarkable scientists navigated motherhood, marriage, cultural responsibilities, and their careers.

BD Deep Science Seminar
High-Dimensional Biology for Biomarker Discovery and Functional Characterization of Novel Cell Subsets

As technologies in our industry advance in complexity, the opportunity to use multiple approaches to answer high dimensional biological questions and expanding our knowledge of immunology.
The presentation was highlighted on how the combined use of high-parameter analytical flow cytometry and advanced single cell multiomic tools (proteomic and genomic) can help define functional murine NK cell subsets.

Use of advanced surface database to guide experimental design reduce batch-effects through high-parameter fluorescence sorting and molecular barcoding perform high-dimensional cell characterization via flow cytometry and AbSeq technologies Bridge the gap between singlecell multiomics and flow cytometry based functional assays was also discussed on the 23rd of June 2022.

Sponsored Students Annual Gathering

On the morning of July 6th an annual gathering for our sponsored students was held for the students to learn more about what we do here at Sidra Medicine, department charts, career paths, and what their different roles and responsibilities could be once they join. Participating departments in the event were: Nursing, Pharmacy, Pathology, Research, and Social Work.

The Graduate Associates Program shared success stories related by previous Graduate Associates who have made it to a successful career path with a significant impact on our patients at Sidra Medicine and to Qatar as a whole. The gathering concluded in a tour of the hospital, and the Research and Pathology laboratories, before networking over lunch.

WISH 2022

An initiative founded by Qatar Foundation in 2013, the World Innovation Summit for Health (WISH) has become a leading global platform where scientists, entrepreneurs and policy makers meet to develop solutions to major health issues facing the world today and explore ways in which innovation can improve these issues for the future. WISH has brought together thousands of the world's healthcare pioneers to its global gathering, both virtual and in-person.

As a catalyst for change, we are uniting the world's most influential thinkers and most brilliant minds, to develop solutions that can improve health outcomes globally. Sidra Medicine's Research Branch was invited to WISH 2022 in August to showcase the unique zebrafish facility serving genomic medicine.

Dr. Sahar Da'as, Manager of the Zebrafish Facility at Sidra Medicine explained to attending visitors, extinguished guests, and VIPs the research platform of functional genomics through integrating model systems. She highlighted the power of zebrafish in Personalized Medicine to develop a tailor-made understanding for patients in whom currently diagnosis fails. The zebrafish is being used in research to advance diagnostics from generating humanized disease models, to contributions to understanding disease progression, through to assessing drugs via in vivo phenotypic screens. Our outcomes in translational research have helped Sidra Medicine patients and other patients across the international community.

Sidra Medicine Signs MoU with Microsoft

Our research division has signed a memorandum of understanding (MoU) with Microsoft to facilitate its digital transformation goals and accelerate its precision medicine and genomics research programs. The MoU was signed at Microsoft Qatar's Lusail office, by Dr. Khalid Fakhro, the Chief Research Officer and Lana Khalaf, General Manager of Microsoft Qatar on August 31.

The MoU signals a series of strategic collaborations and implementations that will enable Sidra Medicine's research division to expedite its technology and cloud adoption on Microsoft's platforms, towards a complete digital transformation.

Dr. Khalid Fakhro said, "The MoU with Microsoft is the start of an exciting collaborative journey with a trusted and cutting-edge technology leader, that will enable us to offer innovative solutions to research challenges. The partnership comes at an opportune time, as we are scaling up our genomics research capabilities to meet growing local and global demands. It is part of our positioning strategy to become a leading healthcare and research facility and a benchmark for precision medicine and personalised healthcare."

The transformation, which will be led by Sidra Medicine's Digital Health team (Research), will use Microsoft Cloud to safely store and access data more quickly and conveniently. It will allow its scientists to perform complex data operations using Microsoft's Data and AI platforms. The division will also utilize HighPerformance Computing (HPC) on Microsoft Azure for industry-specific services to build an ecosystem that can facilitate genomics computing. "It is a distinct privilege to partner with Sidra Medicine's research division as they use Microsoft Azure and its AI and machine learning capabilities to support advanced research and breakthroughs in precision medicine and genomics", said Lana Khalaf, General Manager of Microsoft Qatar.

"I am inspired by this collaboration between medicine and technology and its ambitious goals to lead the way in new discoveries and medical science innovation."

Microsoft will also help enhance Sidra Medicine's research teams' digital capabilities through its National Skilling Program (in partnership with Qatar's Ministry of Communications and Information Technology) and other development initiatives including workshops and training programs.

Chief Research Officer Retreat

The CRO hosted a Research Retreat inviting Managers, Principal Investigators, and Directors of the Sidra Medicine Research Branch at the Education City Golf Club on Sunday 18th September. After a warm welcome and introduction, the CRO presented a refresher of our strategy and Sidra Medicine's tripartite mandate embracing patient care, research, and education. We at Research conduct science in three distinct areas: pediatrics (rare and complex disorders), women's (pregnancy, maternal/child health), and population genetics/genomics.

Sidra Medicine's unique differentiators set us up for unique opportunities for novel gene pathway discovery and patient treatment. Through a seamless integration of Research and Clinical activities to benefit every Sidra Medicine patient, we create OneSidra; One Team, One Mission: Sidra Medicine patients. The large team worked throughout the day to discuss ideas and implementation of opportunities for growth, and how to maximize staff engagement to make Sidra Research the best place to work.

Precision Medicine Functional Genomics (PMFG) 2022

Sidra Medicine's Research Branch successfully concluded the 8th edition of our Precision Medicine Functional Genomics symposium (PMFG 2022) in September to a packed audience of over 640 registered attendees during the course of the four-day event.

PMFG 2022 featured 50 international and local thought leaders and experts who discussed a range of hot topics including research and clinical advances in precision medicine; cancer immunotherapy and treatment; translational genomics and novel treatment programs related to rare and common diseases like diabetes and obesity.

Conference Chairs Dr. Chiara Cugno and Dr. Luis Saraiva said: "The feedback from our peers within the research, healthcare and biomedical industries has been overwhelmingly positive. We want to thank everyone, from our speakers, attendees, sponsors, partners and exhibitors in making this year's PMFG our best yet! We are also proud of how Sidra Medicine has positioned itself within the precision medicine fraternity thanks to the mettle of our own researchers, clinicians and scientists and their contributions in drafting Qatar's personalized health data ecosystem roadmap and truly showcasing how precision medicine has moved from vision to

Dr. Bruno Reversade, Research Director from A*STAR, Singapore, and one of the keynote speakers at PMFG whose presentation on leveraging the power of Mendelian genetics to foster innovation for common unmet medical needs, generated a lot of buzz at PMFG 2022 said: "We are on an exciting path for precision medicine particularly to help those with rare diseases. One of the ground-breaking aspects of our research is that we have harnessed the power of mendelian genetics to identify and validate novel drug targets to treat cancer patients. An example that I shared at PMFG 2022, was research that we conducted with patients with a monogenic disease like Progeria (patients who prematurely age with wrinkly skin syndrome). What we realized is that the same gene that causes this disease in patients – is also often over expressed in cancer. We reasoned, what if we apply this premature aging phenotype to tumors in normal patients? So basically, we used the knowledge from an extremely rare condition and see how we can apply it to treat diseases like liver cancer."

QBRI Research Day

Qatar Biomedical Research Institute (QBRI) held its first annual Research Day on September 28th, 2022 showcasing the thematic research areas conducted at the institute and key infrastructure and core facilities featuring state of the art technologies.
The event was marked by the attendance of various faculty members from Sidra Medicine discovering more closely the research at QBIR and exploring interdisciplinary collaborative opportunities.
Dr Younes Mokrab, head of Medical and Population Genomics at Sidra Medicine was invited to take part in a focus panel session on 'Precision medicine in Qatar: Challenges and opportunities.

The session also featured Dr Hamdi Mbarek manager at Qatar Genome Program and was moderated by Dr Fares Dr. Fares Al Ejeh, QBRI. Dr Mokrab highlighted the advancements achieved at Sidra Medicine as part the strategic partnership with the Qatar Genome Project. He also explained the importance of recent work from Sidra Medicine characterizing the genetic structure of the Qatari population, providing an instrumental tool for patient stratification, quantification of disease risk, treatment, and progression.

Stars of Science

It all began in 2008. Qatar Foundation decided to inspire an entire Arab generation to innovate and create, and Stars of Science was born. As the premier innovation show in the Arab world, Stars of Science – the edutainment TV initiative of Qatar Foundation (QF) – empowers Arab innovators to develop technological solutions for their communities, benefitting people's health and lifestyles, and helping to preserve the environment.

Over a 12-week process, the contestants demonstrate the effectiveness of their solutions in a shared innovation space, competing against time with the support of a team of experienced engineers and product developers. An expert panel of jurors assess and eliminate projects every week across several prototyping and testing rounds, until only four finalists remain to compete for the Jury deliberation and online voting from the public determine the rankings.

Dr. Khalid Fakhro, Chief Research Officer at Sidra Medicine, participated & appeared in episode 5 of Stars of Science Season 14 aired in September 2022 where he distinguished between traditional and precision medicine. Treating patients using population averages is an outdated approach; precision medicine allows us to target treatment, thereby minimizing side effects and maximizing response to treatment, and even eventually predicting possible future medical conditions.

HBKU Research Day

The College of Health and Life Sciences' Annual Student Research Forum 2022 held in September marks the first come-back to live events after the start of COVID. The hallmarks of this forum are its innovation, diversity, and interactivity for all HBKU students. A forum where exchange of new ideas can be translated into improvement of existing research projects or formulation of new ones. More importantly, it is a platform to showcase the excellent work the students are conducting in the College as a reflection of hard work, good mentorship, and updated curriculum.
Sidra Medicine's Research Branch is an avid supporter of HBKU students, and over the last four years, more than 30 students have been mentored by our qualified scientists to successfully complete their MSc and PhD requirements. Dr. Davide Bedognetti, acting Executive Director of Translational Medicine at Sidra Medicine presented on behalf of the Chief Research Officer, Dr. Khalid Fakhro highlighted high-impact scientific publications and research accomplishments HBKU students were enabled by Sidra Medicine to achieve. The event culminated with a live awards ceremony in which the winners for best poster and oral presentations will celebrate with their colleagues and mentors their pride and joy.

Women's Health Conference

The Women's Health Conference 2022 (WHC 2022) took place virtually on October 14-15, 2022 and was a great success. Speakers presented from our auditorium to an audience of over 400 national and international delegates. The conference covered a wide range of issues in women's health, two highly engaging clinical debates and a keynote lecture on the role of aesthetic surgery in women's wellness. Delegates rated the conference highly with excellent feedback and many are looking forward to the next event in 2023.
Dr. Souhaila Al Khodor was invited to present her work on the Omouma study: "The mother and baby cohort at Sidra Medicine, a journey toward precision medicine".

She explained the importance of research as a continuum of care for women attending Sidra Medicine and described the holistic approach used for pregnant women enrolled in the Omouma study. Dr. Al Khodor also spoke about the criticality of the successful collaboration between the OBGYN and research teams while describing the short and long terms outcomes of Omouma. The success of the conference is attributed to the quality of the scientific program, the caliber of the speakers and the tremendous support received from the events and communications team, our IT team and the administrative staff from women's services.

Chief Research Officer All Staff End-of-Year Meeting

The CRO held an All Staff meeting end of last year and awarded the top publishing authors in original articles. The categories awarded were (Student, Research Specialist, Scientist, Junior Investigator, Senior Investigator, Core Facilities, Top Review Article.), and were recognized for their high cumulative journal impact factor.

Top Student Paper - Shimaa Khedr
Top Research Specialist Paper - Eman Aboumoussa
Top Scientist Paper - Ilhame Diboun
Top Junior Investigator Paper - Bernice Lo
Top Senior Investigator Paper - Younes Mokrab
Top Core Facilities Paper - Sahar Da'as
Top Review Article - Ajaz Bhat & Sabah Nisar

QF Empowers Women in Medicine and Science

Women physicians and researchers in Qatar are entrepreneurial and resourceful. They are finding innovative solutions to healthcare problems, and passionate care to those in need. For more women to make achievements in the field of medicine and science, the country offers ample opportunities.
Some senior physicians and researchers at Qatar Foundation's (QF) Sidra Medicine share their insights, inspirations, challenges and advice for young women. Each of them agrees that, despite not always being easy, their journey so far has been fulfilling.
Division Chief, Adolescent Medicine at Sidra Medicine, Dr. Alanoud Al Ansari, said that policies and opportunities in Qatar and at Sidra Medicine have encouraged her achieve career goals through a culturally diverse workforce.

For her colleague, Acting Division Chief of Pediatric Neuroradiology, Dr. Jehan Al Rayahi, QF has played a major role in shaping the career and achieving goals. Dr. Al Rayahi is one of the first ever graduates from the class of 2008 from Weill Cornell Medicine in Qatar, a QF partner university.
While, Dr. Moza Al Kowari, a researcher at Sidra Medicine, encourages all young people to consider science as a career, adding that the pandemic has make clear the importance of science.

Dr. Al Kowari, had a dream to become a medical doctor but due to circumstances has studied biomedical science and earned a Ph.D. from QF's Hamad Bin Khalifa University.
Noora Al Mohannadi, a graduate associate at Sidra Medicine choose her profession as a result of her curiosity and her journey with QF started when she joined Qatar Academy Alkhor (QAK).

Al Mohannadi says that science is an exciting field full of inspiring women. Therefore, her advice to young women is to try and learn from their contributions and seek out supportive mentors.
For Research Specialist II, Laboratory of Immunogenetics, at Sidra Medicine, Fatima Al Ali, QF and Sidra Medicine have played a major role by sponsoring to pursue her honor's and Master's degree.
She says that pursing a degree in science and working in the same field is a great opportunity by itself.

PUBLICATIONS REGISTRY

PUBLICATIONS REGISTRY

CANCER

Vernieri C, Fucà G, Ligorio F, (...), Bedognetti D, Rivoltini L, de Braud F. FastingMimicking Diet Is Safe and Reshapes Metabolism and Antitumor Immunity in Patients with Cancer. Cancer Discov. 2022 Jan;12(1):90-107. doi: 10.1158/2159-8290.CD-21-0030.

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