



معهد دسمان للسكري
Dasman Diabetes Institute



KFAS

أحد مراكز
Center

DDI Services
and Facilities





In this Booklet

Dasman Diabetes Institute (DDI) was established under the patronage of His Highness Sheikh Jaber Al Ahmed Al Sabah, the late Amir of the State of Kuwait, and the Kuwait Foundation for the Advancement of Sciences (KFAS) to combat the confounding prevalence of diabetes in Kuwait. Since its inauguration in 2006 by His Highness Sheikh Sabah Al Ahmed Al Sabah (the current Amir of the State of Kuwait), DDI has become a leading research institute for the study of diabetes in Kuwait. The Institute aims to address the growing epidemic of this condition in Kuwait, through effective programs of focused research, integrated prevention, training, education and treatment.

To achieve this mission, DDI's Sectors (Research, Medical Operations) work to understand the complexity of diabetes and its complications, using a multidisciplinary approach of diabetes research and management.

Our Operations Sector builds and maintains the foundations of the Institute, thereby transforming

philosophies to measurable outcomes. The Sector manages service performance, technological proficiency, data management and employee performance to achieve organizational transformation and financial sustainability.

Our Research Sector represents the backbone that supports the Institute's scientific productivity. A multi-national team of researchers utilizes the technologies and the facilities, set in place by the Operations Sector, to harness the basic scientific knowledge and achieve disease-targeted research. Our pool of talented researchers focus on the epidemiological, genetic, biochemical and immunological aspects of the disorder.

Our Medical Sector is the fuel that drives the Institute's initiatives: research, training, education and health promotion. By adapting an interdisciplinary approach, the team utilizes the highest standards of medical care and latest research findings to tackle all aspects of diabetes prevention, treatment and

management. The Research Sector's novel discoveries in diabetes lend key research findings to contribute to new medical treatments that improve health outcomes.

DDI's Sectors actively collaborate with several national and international renowned institutions in the establishment of various scientific and training programs. These collaborations promote healthy scientific communication and are key to establish DDI as a world-class institution for diabetes research.

This booklet aims to highlight the Institute's technological advances and provide an open channel of communication. We intend to engage researchers, clinicians and external stakeholders to foster an environment of knowledge transfer and collaboration in the diabetes research community.

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Research Sector

The Research Sector at DDI operates a state-of-the-art infrastructure that promotes scientific excellence. The wide range of shared research core facilities aim to foster knowledge transfer and collaboration. In line with the new Research Strategic Plan, the Research Sector has been restructured to deliver the Research Strategy, enhance collaboration, ensure

succession planning and skills transfer. The research activities are carried out by the different Biomedical Research departments and overseen by the Chief Scientific Officer (CSO), supported by the Research Operations and Project Management department and Core Facilities.

Our new research departments focus on specific research themes:

1. Genetics/genomics related to diabetes and metabolic diseases
2. Epidemiology and public health aspects of diabetes and its complications
3. Pathophysiology of diabetes and its complications
4. Clinical care research and clinical trials

Research Operations & Project Management

The Research Operations and Project Management (ROPM) Department provides administrative support in all areas of DDI research and aim to facilitate the communication among the departments and sectors. Working alongside the different research departments and core facilities, the ROPM department is a management function responsible for standardizing project and operations-related governance processes to enable the sharing of resources, methodologies, tools, and techniques.

The ROPM department coordinates all research-related projects, ensuring the appropriate use of resources, setting budgets and timelines, ensuring compliance with guidelines, analyzing research outputs and overseeing research activities. In addition, the ROPM supports research departments in achieving their objectives by monitoring and managing their activities according to the DDI Research Sector 5-year Strategic Plan.

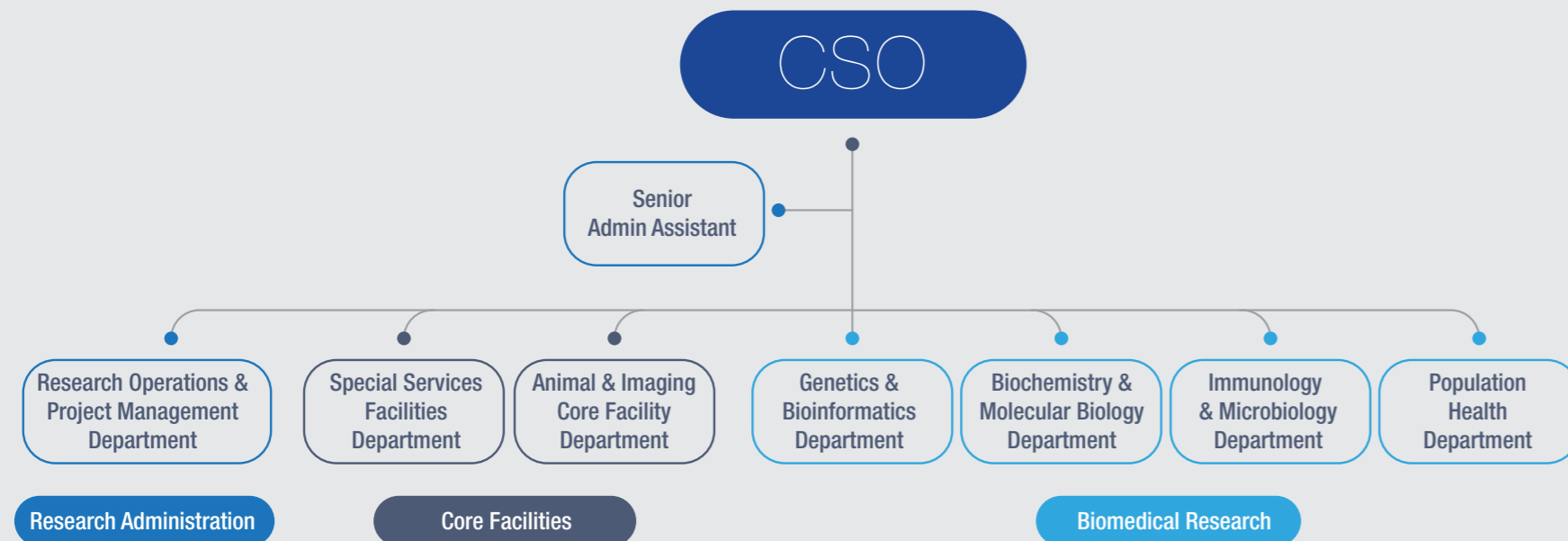
1. **Library, Education, Training and Profile Management:** In the scope of ROPM, the library provides a collection of print and electronic resources that support the Institute's research needs. In addition, the library services coordinate the organization of scientific research programs, seminars and lectures and catalog all new DDI publications.
2. **Writing and Editing Services:** The writing services provided by the ROPM Department streamline existing processes to facilitate the writing and editing of research publications, by ensuring compliance with plagiarism and ethical guidelines, and improving the overall quality of the manuscripts prior to publication.

Aim:

To support scientific staff from all research departments produce high quality publications in respected journals and meetings, and raise the standard of research at DDI

At DDI, writing services can support the development of different types of publications, including:

- Manuscripts at all stages
- Abstracts
- Oral presentations
- Poster presentations



Scientific writing services

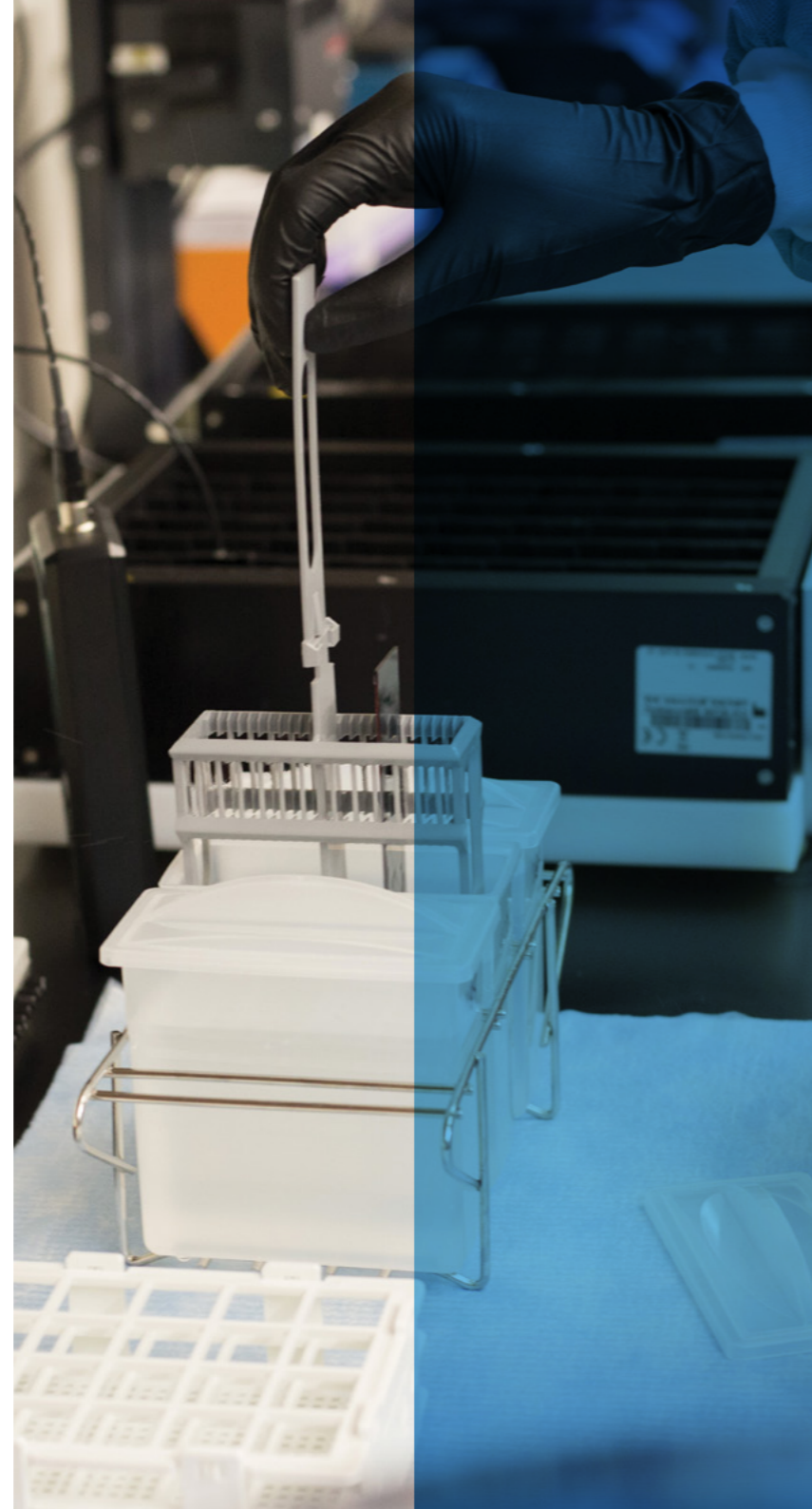
Scientific writing involves writing and editing complex scientific content for a given publication in a clear, concise, accurate and compelling manner

Scientific writing

"Many journals recognize that help from a professional writer can raise reporting standards, improve compliance, and elevate overall editorial quality"¹

The use of scientific writer transfers the writing burden from the staff and speeds up the document development process

1. Chipperfield L et al. Authors' Submission Toolkit: a practical guide to getting your research published. *Curr Med Res Opin.* 2010;26:1967–1982.



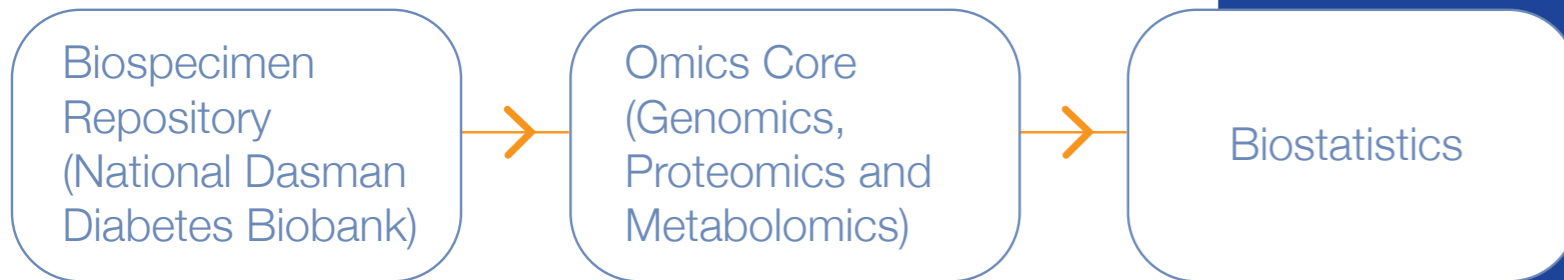
Research Core Facilities



The Research Core Facilities provide state-of-the-art equipment and techniques along with expertise, professional training and management crucial to the development of cutting-edge research. The Core Facilities are collectively run with the aim of promoting best research practices and transparency in utilization processes. Access to the technologies, training and high-quality scientific services of the Research Core Facilities are available to all interested researchers within and outside of DDI.

Special Services Facility

The Special Services Facility is a Core Facility and is composed of three main domains:



The National Dasman Diabetes Bio Bank Core Facility

The National Dasman Diabetes Biobank (NDDB) Core Facility stores various biological samples and is available internally to researchers and collaborators. NDDB can also store and process samples for external research institutions or individuals for potential use. Researchers can utilize the Biobank for its highly specialized

facility that offers long term storage and protection of valuable research materials.

The NDDB operates on standardized and certified protocols. It has restricted access and is equipped with a security control to ensure that all storage of biological samples, their confidentiality

and their traceability are in accordance with the best practices and ethical regulations. The NDDB team has the expertise to investigate, create and implement new ideas and procedures to meet the investigator's/collaborator's needs.

The NDDB Core Facility provides the following services for the investigators/collaborators:

- Pre-analytical sample preparation and handling (time and temperature before and after separation; suitable centrifugation and storage for analytical purposes).
- High quality sample processing under standardized storage conditions (includes processing of blood components; Plasma, Serum, PBMCs and whole blood)
- Nucleic acid extraction from fresh and frozen blood, saliva, buccal swab and tissue samples
- Human and animal tissue processing and histology services tailored to the unique needs of research projects (equipped with cryostat, microtome, tissue microarray, automated and manual slide scanner)
- Paraffin and frozen histology specimens
- Immunohistochemistry (automated and manual)
- Data management, statistical analysis and guidance
- Equipped with -80° ultra-low temperature freezers, liquid nitrogen storage facility

OMICS CORE FACILITY

Proteomics

DDI's Proteomics Core Facility is equipped with latest high-resolution mass spectrometry. The Facility's service can be provided as a collaborative research project or as a paid service. Proteomics services include protein and peptide quantification as well as identification of unknown proteins from various

biospecimens including:

- Serum
- Plasma
- Urine
- Saliva
- Animal and cell line extracted proteins.

These services include:

1. Sample preparation including sample digestion in solution or in gel digestion.
2. Peptide labeling using TMT or other peptide labeling methods
3. Protein labeling using Stable isotopes in tissue cultures (SILAC)
4. Protein identification using state of the art mass spectrometry including Thermo Q-Executive-HF hybrid quadrupole-Orbitrap mass analyzer
5. Protein/peptide quantification using labeled or label free proteins/peptides using state of the art mass spectrometry including Thermo Q-Executive-HF hybrid quadrupole-Orbitrap mass analyzer
6. Post-translational modification identification such as phosphorylation, Acetylation, mono-Di- and Tri-methylation as well as other potential PMs
7. Bioinformatic data analysis using Proteome discoverer/Maxquant or other software based on availability
8. Other custom services based on users' need

Metabolomics

In addition to its proteomics services, DDI has the capabilities to perform metabolomics/lipidomic experiments on various biospecimens including Plasma, Serum, Urine Saliva and other biofluids to identify and quantify various small molecules.

DDI is equipped with high resolution LC/MS as well as GC/MS that can perform various metabolomics and lipidomic experiments. For its collaborators and fee for service customers the following services can be provided:

Solid phase extraction as well as liquid phase extraction biological samples preparation.

1. Targeted and Untargeted metabolic metabolite identification and quantification
2. Targeted and Untargeted lipidomic identification and quantification
3. Biomarker discovery and identification of unknown metabolites
4. Assay development and quantitation of small molecules, drugs and validation of potential biomarkers
5. Bioinformatic analysis of metabolites using various metabolites databases

Genetics and Genomics

The Genomic Core Facility provides resources and services to support the needs for high throughput genomics using state-of-the-art genomic technology for genetic material analysis. The Genomics Core Facility at DDI offers comprehensive services and support for the latest 'omics' experiments and bioinformatic analysis. The services are designed to provide genomic solutions encompassing genomics, transcriptomics, and epigenomics research. The Facility supports a diverse research community that spans basic biomedical research and population genetics.

The Bioinformatics team offers services for standard and custom genomic analysis, data management, development of bioinformatics tools, and access to biocomputing resources. Consultation is available to guide experimental design, and to aid in identifying the appropriate technology for specific research needs. The Core Facilities are available to researchers within DDI as well as other researcher centers and academic institutes.

Services include:

- DNA/RNA sequencing based on high throughput sequencing technology including Illumina HiSeq4000 and including de novo sequencing
- Whole genome or targeted resequencing
- Complete exome sequencing
- Whole genome transcriptome profiling including quantification and transcript isoforms and small RNAs
- ChIP-Seq to detect transcription binding sites across the genome
- Genotyping microarray analysis using the Illumina microarray platform and metagenomic sequencing of genomes

OMICS CORE FACILITY

NovaSeq & HiSeq

1. Whole Genome Sequencing
2. Whole Exome Sequencing
3. Whole Transcriptome Sequencing
 - mRNA Seq
 - Total RNA Seq
 - lincRNA profiling
 - miRNA profiling
 - Exosomal RNA Seq
 - Alternative Splice Variant Profiling

MiSeq

- De-Nova Sequencing
- Targeted Sequencing/ Re-Sequencing
- Methylation Sequencing
- ChIP Sequencing
- Metagenomics/ Microbiome analysis
- Human Leukocyte Antigen (HLA) typing

iSCAN System

- Genome-wide association studies (GWAS)
- High throughput custom multiplex SNP genotyping
- Genome-wide DNA methylation analysis
- Genome wide structural Variant analysis

3730xl genetic analyzer

The ABI PRISM® 3730xl Genetic Analyzer is an automated system for sequencing, sizing, and quantitating nucleic acids. The system achieves unparalleled ease of use through the integration of ABI PRISM® multicolor fluorescent labeling, capillary electrophoresis (CE), and software for data analysis.

The applications include:

- Sanger sequencing
- Fragment analysis



Real-Time PCR

- Quantitative gene expression analysis
- Copy Number Variant (CNV) analysis
- Drug Metabolism Enzyme (DME) Genotyping
- SNP Genotyping/ Mutation screening
- Pathway expression profiling

Our platforms include:

A. Genomics and functional genomics

This platform provides research technologies and instrumentation for high-throughput genomics, epigenomics and transcriptomics along with an extensive set of technologies to study genome structure, dynamics and function.

- The Illumina HiSeq 2000/2500
- The Illumina MiSeq

Next Generation Sequencing platform offers different sequencing applications on the Illumina HiSeq 2000/2500, as well as the MiSeq platforms with library preparation and capture protocols for both DNA and RNA. The Illumina MiSeq is mainly used for more focused applications such as targeted gene sequencing, metagenomics, small genome sequencing, targeted gene expression and amplicon sequencing. To meet the sequencing needs of projects, sample preparation is fully automated on Tecan robotic workstations.

There are several supported applications for Illumina DNA, RNA and epigenetics sequencing.

- Whole Genome Sequencing
- Whole Exome
- Targeted Resequencing
- de novo sequencing
- RNA-Sequencing such as mRNA-Seq, Total RNA-Seq, small RNA-Seq and Ribosomal Profiling
- ChIP-Seq
- Methyl-Seq
- Microbiome / Metagenomics
- Sanger Sequencing
- Epigenomics

OMICS CORE FACILITY

Illumina iScan

The Illumina iScan system is used for whole genome gene expression profiling using Illumina BeadChip products. In addition, the iScan is also used in the scanning of the Illumina Genome-Wide BeadChip products that are used in whole genome genotyping studies. BeadArray technology is utilized in Illumina's iScan System for a broad range of DNA and RNA analysis applications. The applications of Illumina BeadChip technology scan offer analyses, such as genome-wide association studies (GWAS) and copy number variant (CNV) analysis, whole-genome gene expression and methylation analysis, which have helped researchers begin to unravel the complex genetic architecture behind common diseases such as diabetes and cardiovascular disease.

- SNP Genotyping BeadArrays
- Whole-Genome Gene Expression
- Methylation BeadArrays

Applied Biosystems 3730XL

This Genetic Analysis system is used for Sanger sequencing and fragment analysis by capillary electrophoresis. This equipment accommodates single sample users and high-throughput (96-capillary format) projects.

- Plasmids, PCR products, BACs and cosmids.
- DNA fragment analysis applications:
- Microsatellites
- Amplified fragment length polymorphism (AFLP) or SNP analyses analysis
- Applied Biosystems 7500
- Applied Biosystems 7500 FastSystem
- Applied Biosystems QuantStudio 5
- Rotor Gene cyclers
- Roche Lightcycler

This equipment combines thermal cycling, fluorescence detection, and application-specific software to support Real Time-PCR (RT-PCR) experiments. For accurate and sensitive methods of quantifying the abundance of a target DNA sequences. These can be from genomic DNA or from cDNA resulting from the reverse-transcription of RNA.



These Real-Time PCR systems are useful for:

- Quantification of RNA and DNA
- Gene expression using Real-Time PCR
- Genotyping using TaqMan assays (custom or pre-designed)

B. Proteomics profiling, functional proteomic, and metabolomics

Infrastructure for the proteomic platform is centered around state-of-the-art mass spectrometry for MS and LC-MSMS experiments for carrying out protein identification, quantification, determination of post-translational modification. This is complemented by equipment for functional studies.

Equipment:

- Orbitrap LTQ Velos ETD
- Orbitrap Q-Exactive HF
- ultrafleXtreme MALDI-TOF
- Liquid Handling Robot (CyBio Disk)

Applications:

- Protein identification from gel or in-solution
- identification and quantification of proteins in complex mixtures
- quantifying changes in protein expression levels
- Protein quantification by stable-isotope labeling (e.g., iTRAQ™, SILAC)
- Identification of post-translational modifications on purified proteins
- Multi-dimensional peptide separation (liquid chromatography)
- Molecular weight determination of intact proteins by ESI mass spectrometry
- Determination of N- and C-termini of proteins and products of limited proteolysis
- Verification of incorporation of non-natural amino acids
- Untargeted metabolites (from Biofluids, Solid Tissue and Cell Culture)
- Lipidomic (from Biofluids, Solid Tissue and Cell Culture)
- (phospholipid quantitation, Free fatty acid profiles, etc.)
- Amino acid analysis (free amino acids, from plasma or urine)
- Amino acid analysis (with protein hydrolysis, from tissue or cells)
- Polysaccharides Glycolysis (from tissue or cells)
- Steroids

OMICS CORE FACILITY

BioTek Synergy H4 is a versatile multi-mode spectroscopic instrument combining the sensitivity of filter-based optics with the flexibility of monochromator-based optics in one compact instrument for high-performance applications. It can read various plate formats, from 6-well to 384-well plates. EnVision Multi-Label Plate Reader is multilabel reader and among the fastest HTS readers. Sensitive, versatile benchtop reader, the EnVision handles all fluorescence, luminescence, UV-Vis absorbance, fluorescence polarization and time-resolved fluorescence detection technologies.

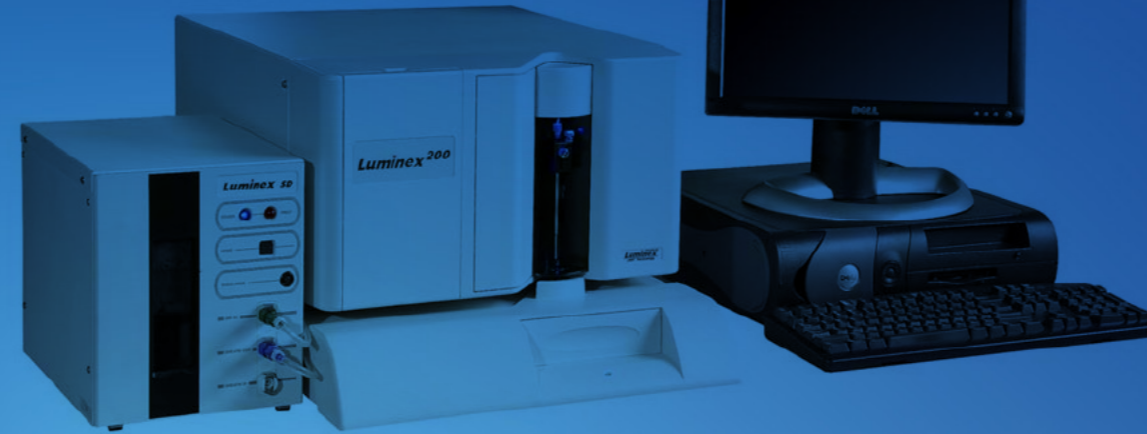
Application: Detection methods include:

- Absorbance in ultraviolet and visible range (UV-VIS)
- Fluorescence intensity,
- Fluorescence polarization (FP)
- Luminescence
- Time-resolved fluorescence (TRF)
- AlphaScreen\AlphaLISA
- Read methods include end, kinetic, spectral scanning, and well-area scanning
- Cell Based Assays
- Luminescence reporter assays
- GFP fluorescence assays

Bioplex200/Luminex200 systems

microplate-based Multiplex Analysis is bead-based suspension system for analyte quantitation in the picogram level. Can perform multiplex analysis of multiple different analytes in a single sample (Up to 100 differentially dyed beads can be used in a single multiplex assay, each conjugated to a different antibody). Multiplex systems are faster and use less sample volume than other technologies such as ELISA and Western Blot. Simultaneously measure multiple analyte in various sample types such as:

- body fluids (serum, saliva, plasma, GCF, wound fluid, etc.)
- cell extracts
- culture supernatants



Target species including human, mouse, rat, non-human primate, canine, porcine, etc. and many applications were developed and include the following fields of life and biomedical science research:

- Cancer Markers
- Cardiovascular
- Cell Signaling
- Cellular Metabolism
- Immunology
- Gene Expression Profiling
- Genotyping
- Endocrinology
- Isotyping
- Matrix Metalloproteinases
- Metabolic Endocrinology
- Neurobiology
- Transcription Factors
- Toxicity

Biostatistics Core Facility

The Biostatistics team at DDI can provide methodological statistical design and analysis for research projects of researchers both within and outside of DDI.

The Facility aims to assist researchers in planning and designing effective projects, from early project conception to fully elaborated study design as well as during data collection and data analysis.

Animal Core Facility & Imaging Core Facility

Animal research has played a vital role in the development of almost every medical treatment used today. From antibiotics and blood transfusions to cutting-edge cancer drugs, much of the medical achievements of the past century have arisen from animal studies. Research using animals continues to make vital contributions to the understanding and treatment of many major health problems we face.

At DDI, we are committed to the highest standards of research. We strongly endorse the principles of the “three Rs”, which entails taking every effort to: Replace the use of live animals, Reduce the number of animals being used, and Refine procedures to ensure degree of suffering is reduced to a minimum.

The DDI Animal Core Facility provides researchers with a central resource for conducting research in animal models. While the central focus of the facility is diabetes research, the techniques employed are useful to several investigators in other fields. The Facility can be utilized by researchers for training purposes, project design and animal model investigations. The team at the Animal Facility can work closely with researchers to design experiments with the appropriate animal model and implement them based on a defined timeline.

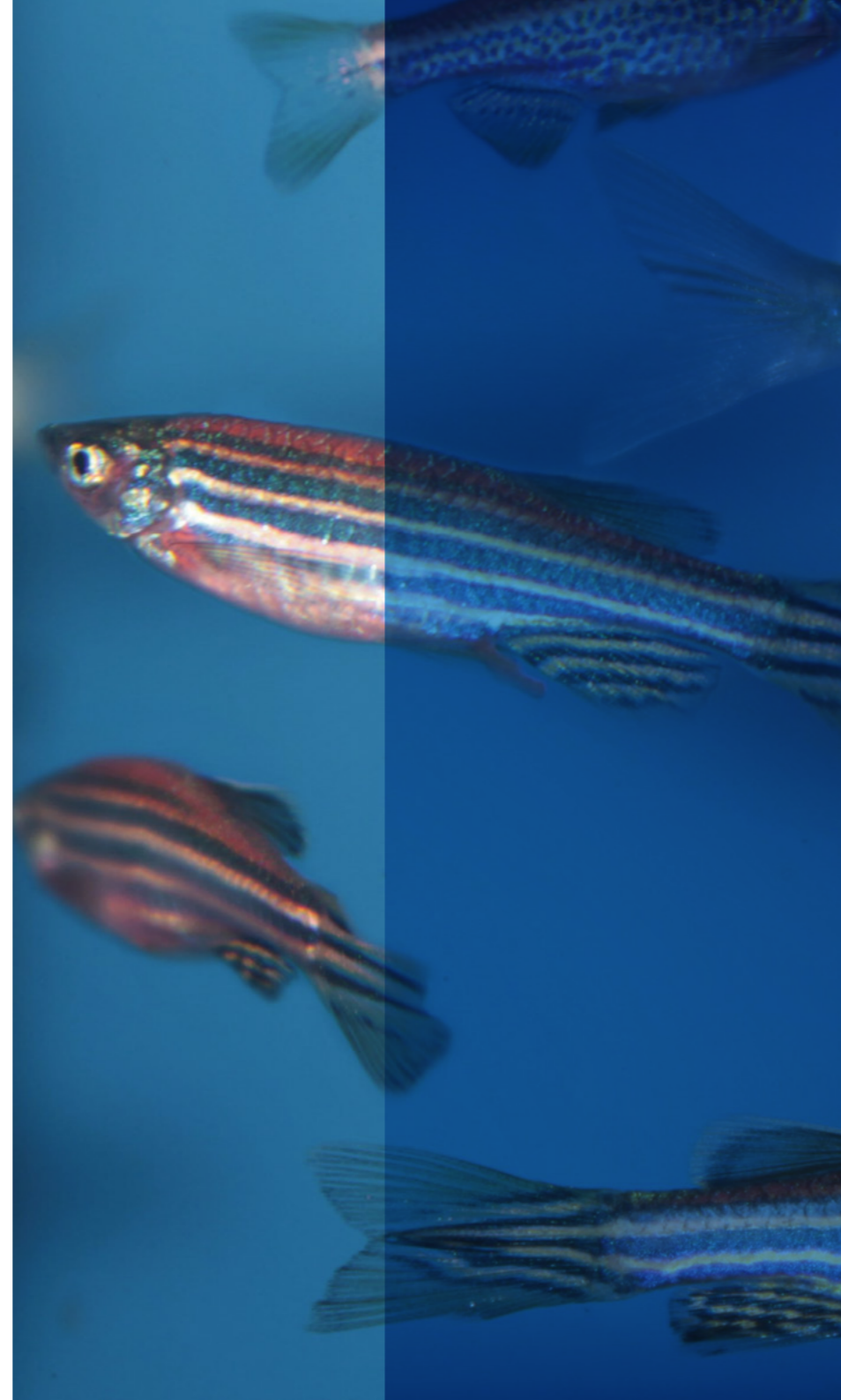
Services Available:

1. Statistical and methodological assessments, including;
 - statistical design of studies
 - sample size calculation
 - assessment of data collection for the analysis
 - methodological and statistical assessment of research projects.
2. Providing guidance to researchers in the use of specialized applications, programming, computation and statistical analysis techniques for interpretation of biological data
3. Maintaining awareness of emerging computational technologies and new statistical methods, especially to work with large data sets
4. Expand the use of advanced computational techniques and statistical analysis, especially Next-Generation Sequencing and the separate DNA Methylation Analysis (RNA-Seq, DNA-Seq, ChIP-Seq and DNA methylation sequencing)

Rodent Platform

Animal care, surgery and pathology

- Rodent colony housing and management, standard veterinary care, and in-house breeding. The animal core currently maintains mouse colonies of BALB/c, C57BL/6j, B6.129SF2/j, B6.Cg-Lepob/j, B6.129-TLR2 knockout (KO), B6(Cg)-TLR4 KO, B6.129S-TNF- KO, and B6.129S2-IL-6 KO mice (on a C57BL/6 background) as well as Sprague-Dawley (SD) rats
- Housing and colony management of immuno-deficient (nude/SCID) mice
- In-vivo animal handling, experimental inoculations, tail vein and intraperitoneal (IP) injection, test substance dosing
- Tail vein blood sampling (plasma/serum) and retro-orbital bleeding (under isoflurane anesthesia)
- Plasma glucose, insulin and triglycerides measurements
- Tissue and organ collections, tissue dissection, and histology
- Body weight monitoring and genetic testing
- Orogastic gavage, body temperature measurements
- Survival surgeries, jugular vein and/or carotid artery cannulation for in-vivo experiments, portal vein catheterization, partial pancreatectomy
- Surgical training on cannulation/catheterization to research staff and summer interns
- Laboratory training (DNA, RNA and protein extractions, tissue and cell staining, adipocyte/stromal cell fraction isolation, PCR/RT-PCR, tissue preparation)
- Necropsy and histology, including specific organ histologic examination, grading and photo documentation as well as immunohistochemistry preparations
- In-vivo imaging (Luminescent, Fluorescent, and CT IVIS)
- Clinical and anatomic pathology evaluation and reporting
- Quarantine per diem services
- Pre-clinical project consultation and study design services



Endocrinology and metabolism (glucose, hormones)

- Phenotyping services to assess endocrine function and metabolic pathways using mouse/rat models of obesity, diabetes, and related metabolic complications
- Chronic and acute induction of obesity, insulin resistance and diabetes by feeding high-fat diet, lipid infusion, streptozotocin injection and phlorizin treatment
- Non-invasive mouse/rat blood pressure assessment using tail-cuff CODA system
- Conduct of in-vivo metabolic function tests and data interpretation including glucose tolerance tests (IV, IP and Oral GTT) and insulin tolerance test (ITT)
- Hyper insulinemic-euglycemic clamp to assess insulin sensitivity and glucose metabolism in awake mice and rats
- Hyperglycemic clamp to assess insulin secretion and pancreatic beta cell function in awake mice and rats
- Glucose concentration assay
- Insulin concentration assay
- Glucagon concentration assay
- Adiponectin concentration assay
- Leptin concentration assay
- Resistin concentration assay
- GLP-1 concentration assay
- GIP concentration assay
- C-peptide concentration assay
- High-throughput Luminex multiplexing (2-plex, 3-plex) assays for serum, tissue, homogenate and cellular levels of hormones, cytokines/chemokines, and metabolites
- Ultra-sensitive ELISA measurements of difficult-to-detect analytes
- Assessment of glucose/lipid metabolism, inflammatory and insulin signaling pathways as well as ER/mitochondrial stress in metabolically important tissues such as adipose tissue, liver, skeletal muscle, and pancreas
- Islet studies including surgical isolation of mouse/rat islets, in-vitro molecular analysis using cultured islets, measurement of beta cell mass, proliferation and cell death, islet structural analysis and histology, ex-vivo islet functional analysis using perfusion system for insulin secretion and insulin content, histomorphological analyses of altered islet structure and mass as well as islet biology and transplantation techniques
- Whole organs such as liver perfusion assay

Energy balance, exercise and behavior

- Non-invasive assessment of energy balance including food/water intake, energy expenditure, respiratory exchange ratio, and physical activity using metabolic cages with temperature and light control
- Non-invasive measurement of whole body/tissue composition of fat, lean and water mass
- Use of running wheel cages for physical exercise
- Accurately measuring the components of energy balance such as energy intake, energy expenditure, body composition, carcass analysis, etc.
- Assessing the effects of physical activity or voluntary exercise (treadmill) on energy balance and metabolism
- Morris water maze
- Acute stress challenge (Exhaustive exercise protocol)
- Chronic variable stress challenge (Chronic endurance protocol)
- Collection of post-stress plasma samples
- Open field test
- Forced swim test
- Tail suspension test
- Sucrose preference test
- Social learning of food stimuli
- Behavioral and cognitive assessments (Conditioned taste aversion, Conditioned place preference, Novel object recognition test)
- Drug trial blinded studies of test compounds and metabolic experiments
- Helping investigators with designing relevant experiments, data analysis and interpretation

Microbiome and host response

- Plasma lipopolysaccharide binding protein (LBP) assay
- Gut permeability assessment using immunohistochemistry and/or expression of tight junction proteins
- Inflammatory profiling/multiplexing assays
- Gut tissue and luminal microbiota transcriptomics

Zebrafish Platform

- Fish holding, general care and in-house breeding (limited or mass scale for production of synchronized eggs)
- Embryonic and larval cultures dissociated cell cultures, and microscopy
- Common manipulation including analgesia/anesthesia, injections, blood collection, necropsy, etc.
- Routine surgery and histology
- Behavioral tracking; and screening/testing of drugs or chemicals using zebrafish embryos
- Larvae microinjection (manual)
- Molecular techniques including protein extraction from embryos for western blots (SDS-PAGE), extraction and purification of DNA/RNA from zebrafish embryos (PCR/RT-PCR), preparation of high-quality RNA from zebrafish embryos, in-situ hybridization, total nucleic acid extraction from zebrafish embryos, ribonuclease protection assays for zebrafish embryos, Zebrafish DNA microarrays/GeneChip™ zebrafish genome arrays, global gene expression analysis (genome-wide gene expression profiling) using zebrafish oligonucleotide microarrays, and global microRNAs (miRNAs) expression analysis following overfeeding/underfeeding, dietary supplementation, induction of insulin resistance and development of type-1/2 diabetes, acute or chronic exposures to biological response modifiers, candidate therapeutic agents, drugs, chemicals, heavy metals, toxicants and environmental pollutants etc.
- Live body imaging (IVIS)

Training

The core also provides laboratory teaching for various research techniques.

Small Animal Imaging

We provide small animal imaging using the In Vivo Imaging System (IVIS) radionuclide imaging (CT), optical imaging (depth resolved or planar fluorescence bioluminescence ultrasound and, most recently, multispectral optoacoustic tomography). There are processes for animal handling (e.g., anesthesia, infusion, monitoring vital signs). AF staff can facilitate and undertake developmental studies for implementation of new imaging protocols and evaluation of methods.

The Animal Facility has a laboratory on location and has computer capabilities for data analysis and image archiving.

Core leaders can advise researchers on:

- Experimental planning (optimal experimental approaches, image manipulation, and statistical analysis, coordinating with the Institutional Animal Care and Use Committee and Safety and Business Continuity)
- Implementing investigations (access to instruments and scheduling experiments)
- Data analysis and validation and data archiving
- Procuring all animals used in teaching, research, and testing programs
- Quarantining and conducting health surveillance of animals
- Providing veterinary care and husbandry to research animals
- Partnering with IACUC to assure compliance with federal regulations, funding agencies' policies, and state and local regulations regarding the care and use of animals
- Assisting faculty and students in planning and conducting research and teaching programs that require animals
- Proof in principle investigations
- Once experimental protocols have been established, routine investigations can be performed on a cost recovery basis by dedicated, skilled technicians.
- Customized model development to meet the individual needs of the researcher.
- Assist researchers in writing internal Animal Care and Ethics Committee.

Biomedical Research Departments



Genetics and Bioinformatics

The Genetics and Bioinformatics Department provides researchers with access to advanced analytical tools at a range of levels, from basic bioinformatics to full scale scientific collaborations. At the Genetics and Bioinformatics Department, we provide with services within all major areas in bioinformatics analysis, sequence analysis, analysis of high-throughput sequencing data, protein structure analysis, analysis of DNA variation, genetic linkage studies, microarrays, general gene association studies, statistical genomics, database access, and web services.

Services Available:

- Consulting on experimental design of high-throughput projects
- In-house training on bioinformatics tools and databases
- Implementation and customization of various software tools
- Setup and development of automated data analysis pipelines for common assays
- Data quality assessment, processing, visualization, interpretation and presentation of results
- Development of novel tools and custom methods for specific analysis tasks
- Data mining of datasets, correlation and integration of results



Computational and data storage facility:

- DDI hosts a solid data analysis and storage platform. Expertise in parallel computation to process large amounts of data rapidly and efficiently.

Genome wide SNP genotyping data analysis service:

- Sample and study power calculations and study designs
- SNP genotype calling from microarray platforms and implementation of platform specific quality controls. Identification of genetic relatedness and genetic ancestry of samples. Discovery of disease risk variants and prediction of disease risk. SNP imputation and statistical analysis for SNP associations with disease traits.
- Discovery of copy number variation from SNP array platform and assessment of their relationship with disorders.

Genome wide Transcriptome and e-QTL analysis service:

- Whole genome transcription signal/read count normalizations using suitable methods. Appropriate statistical method usage based on study design. Data annotation using public repositories. Mediation and correlation analysis of SNP effect on transcription levels (e-QTL).

Genome wide micro-RNA analysis service:

- Whole genome microRNA signal/read count normalizations using suitable methods and appropriate usage of statistical methods based on study design. Assessment of microRNA regulated gene expression.

Genome wide DNA methylation analysis service:

- Whole genome assessment of methylated regions, signal normalizations. Mediation and correlation analysis to assess the effects of methylation sites in transcription.

Next Generation Sequence (NGS) based data analysis service:

- **Whole Exome Sequence Analysis:** Analyze full exomes using in-house pipeline from raw sequence data through the process of cleaning, alignment, variant calling to analysis-ready vcf file with variant effects summary.
- **Whole Genome Sequence Analysis:** Analyze human whole genome sequences using in-house pipeline from raw sequence data through the process of cleaning, alignment, variant calling to analysis-ready vcf file with variant effects summary
- **RNA-seq data analysis:** Quality Control, Alignment and Quantification. Identify differentially expressed and significant genes by comparing between conditions such as drug-treated vs non-treated and up- or down-regulated.
- **Variant Annotation:** Complete variant annotations like global population frequencies, gene features and pathogenicity prediction scores.

Biological database development:

- Expert in web-based database development using latest technologies. Research community engagement interface development and database maintenance.

Statistical analysis of Proteomic data:

- Univariate or multivariate test to establish associations between protein levels and the variable of interest, heatmap analysis, building of diagnostic models and more.

Kuwait Genome Center

The Kuwait Genome Center (KGC) is an integral part of the DDI fundamental goal aiming to further improve the research landscape of genomics in Kuwait. Sustaining capability and expertise in genomic research is a strategic priority for the KGC to improve health using genomic data, particularly to advance personal healthcare which will restrain healthcare costs. Moreover, significant new research and business opportunities can be created in Kuwait and will enhance recognition of the value of genomics in society and policy makers in addressing various health, ethical, environmental, social and economic challenges.

KGC will provide state-of-the-art technologies, expertise and services to the research community inside and outside DDI, as well as collaborators and industrial partners with high quality and interactive/supportive approach. The center provides a quality, consultative and cost-effective genomics service to advance innovative research leading to improved healthcare and to support medical research excellence and clinical delivery.

Its task would also be to promote precision medicine to; directly impact the patients' health, reduce the social and economic burden of diseases, improve to the use of genetics knowledge, and mobilize citizens' dialogue and opinion of genomic knowledge.

The Center focuses on the genetic and genomic research, focusing on next-generation sequencing (NGS), transcriptomics, micro-array-based strategies, bioinformatics. Projects at KGC range from basic research to diagnostics and applications to clinical and public health.

Key available Equipment

- Illumina HiSeq 2500
- Illumina MiSeq
- Illumina iScan
- Applied Biosystems 3730XL
- Applied Biosystems 7500
- Applied Biosystems 7500 FastSystem
- Auto-LiPA 48 for HLA studies
- Tecan Freedom EVO Liquid Handling system
- Bravo, Agilent Liquid Handling system, G54004

The Medical Sector has a unique and innovative approach. This setting contributes to the best medical care and research results. Through effective collaborations with internal and external entities, the Medical Sector has aligned its' outcomes with DDI strategic objectives and initiatives. Using clinical expertise, the Sector initiates research activities for the treatment, management and prevention of diabetes and its complications.

The Medical Sector supports and delivers the following DDI strategic themes:

1. Supports the Research Sector in the delivery of the Epidemiology, Etiology, Genetics and Pathophysiology of Diabetes
2. Prevention and Management of Diabetes
3. Education and Training Development

By measuring the impact and outcomes of the research themes, the Medical Sector continuously maximizes the use of its resources. These resources include:

1. Education and Training
2. Therapeutic and Patient Care
3. Lifestyle and Wellbeing: Medical Fitness Center and Nutrition
4. Clinical Care Research and Trials
5. Dose Adjustment for Normal Eating (DAFNE)

Medical Sector



Services

CHIEF MEDICAL OFFICER (CMO)	
CLINICAL OPERATIONS & GOVERNANCE OFFICE	
THERAPEUTIC & PATIENT CARE	CLINICAL CARE RESEARCH & TRIALS
EDUCATION & TRAINING (SIMULATION & HEALTH PROMOTION)	DAFNE
DIAGNOSTICS (IMAGING)	LIFESTYLE & WELL-BEING (NUTRITION, MFC)

Therapeutic & Patient Care

The Therapeutic & Patient Care Department not only optimizes medical services and educational sessions but also supports clinical research and trials. The Therapeutic & Patient Care Department is made up of several clinics that aim to manage and prevent diabetes mellitus and its complications. Below is a list of all the clinical services within this Department:

- Adult Diabetology
- Pediatrics
- Podiatry
- Ophthalmology
- Dental
- Neurology
- Nephrology
- Cardiology
- Dermatology
- ENT
- Physical Medicine & Rehabilitation
- Painful Diabetic Neuropathy

Other departments that support the clinical services to provide quality care, research and trials include:

- Health Information Management
- Nursing
- Clinical Laboratory
- Pharmacy



Podiatry Clinic

Foot problems are a major cause of morbidity in people with diabetes. Diabetes can reduce the blood supply and cause a loss of feeling to the feet. If not treated appropriately, foot problems can lead to amputation. The prevalence of diabetes is also expected to increase dramatically making the availability and accessibility of evidence-based good quality diabetic foot management of vital importance.

There are recognized evidence-based best practices in prevention, treatment, and management of diabetes foot problems that, if implemented, will not only improve patient outcomes but also reduce cost.

The DDI Podiatry Clinic provides specialist assessment and treatment for high risk patients with diabetic foot diseases ranging from prevention and education of patients, to identify and treat existing problems such as foot ulcers and Charcot's neuroarthropathy, before they get worse.

In close collaboration with our diabetes consultants and other specialties, the clinic will ensure that patients receive comprehensive evidence-based clinical care.

We always aspire to do better for our patients, and are involved in education sessions with patients, their families, nurses, medical students, physicians and other healthcare professionals. We collaborate in clinical research with many departments and institutes to advance our knowledge of diabetic foot complications and share our results in scientific papers to help others in healthcare.

Ophthalmology Clinic

Routine Clinical Procedures

- Visual Acuity - all patients attending Ophthalmology clinic will undergo visual acuity testing before consulting the Ophthalmologist. The test is used to determine the smallest letters that can read on a standardized chart (Snellen chart).
- Pupil dilation prior to eye examination - as per physician's orders, dilating drops will be instilled in patients' eyes, after securing verbal consent and explaining the side effects of the drops. Allergy status will always be verified beforehand.
- Retinal Photography - uses a fundus camera to record color images of the interior surface of the eye. Retinal screening is available every day; results are reviewed by the Ophthalmologist. Appointment with the specialist Ophthalmologist will be secured, according to the results.
- OCT (Optical Coherence Tomography) - is a non-invasive imaging test. OCT uses light waves to take cross-section pictures of the retina. With OCT, the ophthalmologist can see each of the retina's distinctive layers.



- Slit Lamp Examination - is a special microscope with light that lets the doctor examine the interior of the eyes. At this time, the intraocular pressure will be checked, if needed.
- Visual Field Test - this test charts how wide an area can be seen, and how sensitive the vision is within this area. The visual field test assesses whether the vision is being affected by the function of the eye, nerves and brain, rather than how well the eyes focus.
- LASER treatment - also known as retinal photocoagulation (PR). This can be for specific region of the retina (FRP) or for the full retinal (PRP). Due to uncontrolled blood sugar, new and abnormal blood vessels start to grow on the retina. These new blood vessels are quite fragile and likely to bleed leading to loss of vision. This can be prevented by LASER treatment which shrinks the new blood vessels and makes them disappear.

Clinical Care Research & Clinical Trials

At Dasman Diabetes Institute, we are providing patient care alongside diabetes research to improve the type of care we deliver. The clinical research and clinical trials we conduct help us learn more about diabetes, its complications, and new ways to treat and manage it.

A clinical trial is a research study in which participants are assigned to new treatments, interventions or tests designed to detect, prevent, treat or manage medical conditions. Clinical trials are the main method that researchers use to find out if a new treatment, like a drug, diet or device, is safe and effective for patients. DDI is conducting several clinical trials in the field of diabetes. Participating in a clinical trial has several benefits such as having access to the most current treatments, having a dedicated team of experts providing care, and careful monitoring of treatment results. Finally, participation in research may help people with diabetes, now and in the

future, both in Kuwait and around the world.

Another aspect of our research is looking at how we can improve the quality of life for people living with diabetes. To be able to help people live better with their diabetes, we strive to provide patient-centered care where we focus on the needs of each individual patient. This includes respecting the patient's values, preferences and expressed needs, as well as involving them in their own health care plan.

For patients with caregivers (people such as family, friends, or paid professionals who provide care), they are also involved as they are a part of the patient's life and are important in achieving patient's desired health outcomes. Involving diabetes patients, their caregivers and the public in designing and improving diabetes services can transform people's lives, improve their care and help generate new knowledge and understanding of their lives.

To do this, we use interviews and focus groups to understand and explore people's beliefs and experiences relating to diabetes. For example, their experience with fasting during Ramadan and managing their diabetes can help us provide better advice and services to ensure people are able to fast in a safe manner and are satisfied with their care. To be able to conduct all this research, we encourage people to be involved in it, whether through participation or active involvement in studies.



Education & Training

The Education & Training Department plays an essential part in education and health awareness of diabetes management to people with diabetes, students, healthcare professionals and the public. Our certified diabetes educators have considerable experience in the field of diabetes and diabetes management. Patient education is conducted in outpatient clinics and tackles the different aspects of diabetes management. Educational clinics include:

- Diabetes Educators
- Nutrition
- Pharmacotherapy

In addition, we provide screening across the country through our various activities in the community using our Mobile Diabetes Clinic.

Clinical Skills Center (CSC)

The CSC, an accredited CPD provider organization, is committed to provide opportunities for training and development for healthcare providers and the public. It aims to deliver the highest quality, relevant and up-to-date educational activities to enhance the knowledge, skills and attitude

of the stakeholders, to foster self-development and efficiency that will ultimately benefit the community they serve. The Center has been certified by the American Heart Association (AHA) and Kuwait Institute of Medical Specialization (KIMS). The medical staff deliver Basic Life Support (BLS), Advanced Cardiac Life Support (ACLS), Advanced Trauma Life Support (ATLS), and other courses to medical students, healthcare professionals and the public. The CSC offers Internship Programs, as well as:

Life Support Courses

- Heartsaver First Aid
- Heartsaver CPR
- Heartsaver First Aid and CPR AED (Full Course)
- Heartsaver Pediatric First Aid CPR AED

AHA Courses (Designed for Healthcare Professionals)

- American Heart Association courses designed for healthcare professionals
- Basic Life Support
- Advanced Cardiac Life Support
- Airway Management

- ECG and Pharmacology
- HeartCode Online and Classroom (HeartCode ACLS / HeartCode BLS)

Simulation Courses (Designed for Healthcare Professionals)

- Designed for Healthcare Professionals
- Vascular Access
- Safe Injection Techniques
- Nasogastric Tube Insertion (NGT)
- Basic Suturing
- Advanced Suturing
- Urinary Catheterization
- Vital Signs
- Wound Management
- Phlebotomy
- Dosage & Calculations
- Arterial Blood Gas Analysis
- Fluid & Electrolyte Balance
- Scrubbing, Gloving & Gowning
- Megacode & Team Resuscitation (Part 1)
- Megacode & Team Resuscitation (Part 2)

We also offer ATLS Advanced courses and Instructor courses.

DAFNE Unit

One of our successful programs at DDI is DAFNE, which is a structured education program aimed for people with type 1 diabetes. DAFNE stands for Dose Adjustment for Normal Eating, and it helps people manage and live well with their diabetes. DAFNE is an evidence-based educational program with over 60 publications. This international program can be found in the UK, Germany, Ireland, and Singapore, with DDI endorsed as the training center in the Middle East.

DAFNE is a program aimed for people with type 1 diabetes who are 18 years and above. Each course is run by two DAFNE educators who have expertise in diabetes and nutrition. Through structured education over 25 hours, participants learn how to calculate or estimate their carbohydrate intake for each meal and adjust their insulin dose based on that, plus learning self-management skills to deal with illness, hypo/hyperglycemia, and exercise. The course is interactive, and participants meet other people living with diabetes, and they learn from their experiences as well as sharing their own.

By using the skills and knowledge learned, DAFNE graduates can improve their blood glucose control. Graduates have said that it not only helped them gain better control of their blood glucose, but it also gave them the confidence to manage their diabetes better. All graduates are followed up as part of this long-term education program. It helps participants live well with diabetes, aims to allow them to lead as normal a life as possible and reduces the likelihood of long-term complications. In addition, DAFNE has been shown to improve HbA1c levels, reduce the occurrence of severe hypoglycemia and diabetic ketoacidosis episodes, and reduce hospital admissions. It also improves patient care by improving their quality of life. DAFNE allows people to fit diabetes into their lifestyle, rather than changing their lifestyle to fit in with their diabetes. We accept self-referrals, and participants can contact us on 99932363 or 99323630 to start living well with type 1 diabetes, or email us at DAFNE@dasmaninstitute.org.



Diagnostic Imaging Center

Diagnostic Imaging Center (DIC) of Dasman Diabetes Institute (DDI) offers quality radiology investigations to the people of Kuwait. DIC is equipped with state-of-the-art equipment, delivering quality output. As part of the accreditation standards, DIC maintains and practices the highest quality of patient care. Stringent appropriateness criteria for performing radiology tests are practiced as per European and American radiology standards to ensure safety. DIC assures excellent quality of procedures and reports through highly experienced and competent staff. Besides patient investigations, DIC is also actively involved in research projects and scientific/academic activity of DDI. DIC participates with various departments of the Institute in their respective research work.

A . Magnetic Resonance Imaging (MRI)

Magnetic Resonance Imaging (MRI) is a procedure that is non-invasive and does not involve the use of any

radiation. MRI uses a very strong magnet, radiofrequency pulse and a computer to produce detailed images of organs, tissues, bone and other internal structures of the body. A radiologist interprets these images to aid in the diagnosis and treatment of certain medical conditions. DDI has two state-of-the art MRI scanners - a 3 Tesla scanners with very high resolution, specialized imaging and a wide-bore 1.5 Tesla scanner with advanced scanning and post-processing capabilities. In addition, the wide-bore 1.5T MRI scanner can better accommodate claustrophobic and larger patients.

B. Computed Tomography (CT Scan)

Computerized Tomography (CT) is a non-invasive procedure which uses X-rays. X-rays are taken at different angles and a computer processes the information to create cross-sectional images of nearly any part of the body including bones, blood vessels, lungs,

abdominal organs and soft tissues.

DDI offers advanced CT technology to our patients ensuring high quality of images while using the least possible radiation dose to the body. We offer advanced evaluation of kidney stones to facilitate specific treatment plans.

C. Ultrasound

Ultrasound uses high frequency sound waves and their echoes to see what is going on inside the body. A probe sends sound waves into the body and depending on the echoes received back, 2D images are formed on a screen. The radiologist then interprets these images and makes a report. The scan is safe and painless. DIC houses two advanced ultrasound scanners for performing a variety of scans for the entire body.

D. Vascular Lab

Functional (Physiologic) testing is performed on this equipment (ParksFlo) with Doppler technology for patients with pain and arterial and venous blood flow problems in limbs (diabetes-related, varicose veins, venous thrombosis etc.).

A dedicated vascular lab is available in DIC to cater to patients, especially patients with diabetes, for their specific needs.

E. X-ray

An X-ray is a common imaging test used by doctors to see inside the body. Although this test makes use of radiation, the potential benefits outweighs the risks in most cases. X-rays can help diagnose, monitor and treat many medical conditions.

We are equipped with a fully digital X-ray machine for a wide range of applications. A dedicated dental X-ray machine is also available, to perform a complete jaw evaluation (Orthopantomogram-OPG).

F. Bone Mineral Densitometry (BMD)

Bone mineral densitometry (BMD) is a procedure to measure bone density that is non-invasive and uses a very small amount of radiation. This test is very useful to assess osteoporosis – a condition where the bones become weak and brittle and are prone to fractures.

We offer screening for osteoporosis and whole-body composition for fat evaluation.

Lifestyle & Wellbeing

One of the main approaches in diabetes prevention is maintaining an optimum lifestyle and wellbeing through healthy eating and exercise. The Lifestyle & Wellbeing department is an innovative service which combines both the Nutritional Department and the Medical Fitness Center, where participants start regular exercise under the supervision of the fitness trainers and medical team, who regularly monitor the participants' blood glucose levels and overall performance and progress.

Nutrition Unit

The Nutrition Unit at Dasman Diabetes Institute integrates clinical care with research and audit to ensure we are offering our patients the very best care. Our clinical programs include:

A. Remission Clinic

In this clinic, participants will be guided towards remission of type 2 diabetes. This means that the participants can come off the diabetes medication and have normal blood sugar. In general, remission is easier to achieve if participants have had type 2 diabetes for less than 6 years. However, even in people who have had

type 2 diabetes for longer, removal of some or all medications is possible. We offer several diets for achieving this, including total meal replacement using commercial meal replacement products; low-carbohydrate diets and very low energy diets (approximately 800 kilocalories per day) using food. We also offer a meal delivery service to help achieve the remission goals.

B. DDI Diet Service

For patients with type 1 and type 2 diabetes we offer a tailored meal delivery service. Patients/people with type 1 or type 2 diabetes can select the menu which patients prefer with the dietitian to ensure it meets the clinical needs. We will be offering a variety of menus including low-calorie, low-carbohydrate, high-protein and vegetarian options. Blood sugars, blood pressure and diabetes will be monitored at regular visits at DDI and if needed, adjustments can be made to the meal selection.

C. World excellence in carbohydrate counting

In addition to our DAFNE team for adults, we are also developing group- and individual-based education initiatives to help children learn how to count carbohydrates. These include

Kick-Off for 11-13-year-old children and a new workbook developed by a dietitian alongside an expert in educational graphic design and child psychology.

D. Research

In addition, we are also carrying out world-leading research into the effect of diet on the management of type 1 and type 2 diabetes, including:

- A dose-response study into the effect of carbohydrates on blood glucose (D-ROC2): This study is seeking to find out how low carbohydrate should be in the diet to lower blood sugar levels. This will help us to give more accurate advice to our own patients and help people with type 2 diabetes worldwide.
- Time restricted feeding: we will be assessing whether time restricting feeding (where a person only eats during certain time periods during the day) can help people improve their type 2 diabetes and even come off medications.
- Weight loss maintenance study: We will be running the largest remission of type 2 diabetes study in the world which will evaluate whether different types

of diet and exercise are better at helping people stay off diabetes medications.

Medical Fitness Center (MFC)

The Medical Fitness Center (MFC) is a medically-oriented gym that offers high quality services to the public in Kuwait. The Center promotes a healthy lifestyle for the public through the delivery of scientifically designed fitness programs.

The MFC is the ideal fitness center for people with diabetes. They receive a complete assessment by a medical doctor upon joining, as well as ongoing monitoring of their vital signs. The Center's fitness instructors design personalized safe and effective fitness programs, catered to people with diabetes, to help them improve glycemic control and avoid diabetes complications.

The Medical Fitness Center also cater those healthy individuals who needs to improve their fitness level.

Services

- Blood tests and ECG
- Medical clearance by the MD
- Body composition analysis
- Anthropometric measurements
- Cardiopulmonary exercise testing or 6 minute-walk tests
- Exercise prescriptions and individualized exercise programs
- Blood glucose and blood pressure monitoring before and after exercise
- State-of-the-art gym equipment and walking track
- Group exercise classes
 - Core & More
 - Aqua
 - Yoga
 - Pilates
 - Fit Ball
 - Inner Balance
 - Shape & Tone
 - Cardio / Strength Training
 - Personal Training
- Consultation with a dietitian
- Fitness assessment
- Diabetes education for members with diabetes

Clinical Laboratories

The Clinical Laboratories (C.L) is one of the units in the Medical Sector, it is ACI and CAP certified, offering high quality services to the public in Kuwait. The laboratory mission is patient's safety and quality of services; thus, the lab is under strict national and international Quality Assurance programs.

The C.L provide DDI physicians with laboratory tests requested before patient's next visit. They receive a complete lab tests upon joining, as well as ongoing monitoring of their blood glucose, lipid profile, complete liver and kidney function tests and other more specific tests to differentiate between the types of diabetes. Laboratory tests will help physicians to complete the diagnosis and to monitor the effectiveness and dose of the treatment.

Clinical Laboratory Units:

Phlebotomy

- To extract and collect blood and other body fluids samples from research and DDI patients.
- To train new laboratory staff,

nursing staff, and students.

Microbiology & Serology Unit

- To process microbiology routine and cultured specimens, and serology samples.

Hematology & Coagulation Unit

- To process hematology and coagulation samples.

Biochemistry Unit

- To process serum chemistry samples, human urine chemistry, hormones, specific proteins, and whole blood samples for clinical chemistry tests.

Clinical Laboratory and research

- DDI Clinical Laboratories provide its services for the Research Sector too, clinical trials and other national research by planning with the P.I. the required number and quantity of samples for their projects, other related issues, and processing the required clinical lab tests.
- Furthermore, C.L participate with clinical research through retrospective studies that highlights the correlation between diabetes and certain lab findings.

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