DDI Services and Facilities
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 multinational 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 institute 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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- Omnia Care Facility
- Biostatistics Core Facility
- Animal & Imaging Core Facility

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- Sabah Al Ahmed Genome Centre (SAGC)

## RESEARCH SECTOR
- National Dasman Diabetes Biobank
- Omnics Core Facility
- Biostatistics Core Facility
- Animal & Imaging Core Facility
The Research Sector at DDI operates a state-of-the-art infrastructure that promotes scientific excellence. The wide range of shared research core facilities aims 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

The Research Operations and Project Management (ROPM) Department provides administrative support in all areas of DDI research and aims 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. It also 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 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.

Specifically, writing services include:

- Writing the bulk of the text, with advice and direction from the authors
- Perform literary research
- Ensure scientific accuracy and proper analysis of data
- Proofread and ensure correct use of grammar
- Format, edit and style materials according to target journal/scientific meeting
- Ensure compliance with ethical and authorship guidelines
- Coordinate the review process before and after submission

Many scientific 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

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 practices. 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:

- **Biospecimen Repository (NationalDasman Diabetes Biobank)**
- **Omics Core (Genomics, Proteomics and Metabolomics)**
- **Biostatistics**

### The National Dasman Diabetes Bio Bank Core Facility

The National Dasman Diabetes Biobank (NDBB) Core Facility stores various biological samples and is available internally to researchers and collaborators. NDBB 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 NDBB 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 best practices and ethical regulations. The NDBB team has the expertise to investigate, create and implement new ideas and procedures to meet the investigator/collaborator’s needs.**
Solid phase extraction as well as liquid phase extraction biological samples preparation.

1. Targeted and Untargeted metabolite metabolite identification and quantification
2. Targeted and Untargeted lipidomic identification and quantification
3. Biobank 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, transcriptomic, and metagenomic sequencing. 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
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 highthroughput genomics, epigenomics and transcriptomics along with an extensive set of technologies to study genome structure, dynamics and function.

1. The Illumina HiSeq 2000/2500
2. The Illumina MiSeq

Next Generation Sequencing platform offers different sequencing applications on the Illumina HiSeq 2000/2500, as well as the MiSeq platform 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 Sequencing
- Targeted Re-Sequencing
- de novo sequencing
- RNA-Seq
- Alternative Splice Variant Profiling
- Microbiome / Metagenomics
- Human Leukocyte Antigen (HLA) typing

B. MiSeq

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

OMICS FACILITY

1. Whole Genome Sequencing
2. Whole Exome Sequencing
3. Whole Transcriptome Sequencing
   • mRNA-Seq
   • Total RNA-Seq
   • IncRNA profiling
   • miRNA profiling
   • Exosomal RNA-Seq

Alternative splice Variant Profiling

The ABI PRISM® 3730xl Genetic Analyzer is an automated system for sequencing, sizing, and quantifying 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
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• Sanger sequencing
• Fragment analysis
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 BeadScan technology span many areas, such as genome-wide association studies (GWAS) and single nucleotide variant (SNV) analysis, whole-genome gene expression and methylation analysis, which have helped researchers begin to unravel the complex genetic architectures 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

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. This can be from generic DNA or from cDNA resulting from the reverse-transcription of RNA.

OMICS CORE FACILITY

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 proteomics, 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 modifications. This is complemented by equipment for functional studies.

Equipment:
- Orbitrap LTQ Velos ETD
- Orbitrap Q-Exactive HF
- Rotor Gene (Qiagen, Bio-Rad)
- Applied Biosystems 7500 FastSystem
- Applied Biosystems QuantStudio 5
- Roti-Gene (Roche)
- ultrasafe MALDI-TOF

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 (iTRAQ, iTRAQ™, SILAC)
- Identification of post-translational modifications on proteins
- Multi-dimensional peptide separations (liquid chromatography)
- Molecular weight determination of intact proteins by ES mass spectrometry
- Determination of H-C, N-C, O-C or S-C bond products and proteins of limited proteolysis
- Verification of incorporation of non-natural amino acids
- Untargeted metabolites from biofluids, solid tissue and cell culture
- Lipidomics from biofluids, solid tissue and cell culture
- Amino acid analysis (with protein hydrolysis, from tissue or cells)
- Amino acid analysis (free amino acids, from plasma or urine)
- Polysaccharides (glycolysis, from tissue or cells)
- Steroids
- Pentoses
- Analysis of carbohydrates
BioTek Synergy H4 is a versatile multi-mode spectroscopic instrument combining the simplicity of the plate reader 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 a 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
- 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**
- Bead-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 analytes in various sample types such as:
  - body fluids (serum, saliva, plasma, O2, wound fluid, etc.)
  - cell extracts
  - culture supernatants

**OMICS CORE FACILITY**
- 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 sciences 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 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 entail 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 investigations in other fields. The Facility can be utilized by researchers for training purposes, project design and animal model investigations. The team of 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 computer applications, programming, computational and statistical analysis techniques as well as interpretation of statistical data.
3. Maintaining awareness of emerging computational technologies and translational research tools including work with large scale data.
4. Expand the use of advanced computational techniques and statistical analysis, especially Next-Generation Sequencing and DMR metric profiling.
   - RNA-Seq, DNA-Seq, ChIP-Seq and DMR methylation sequencing.

Animal research has played a vital role in the development of almost every medical treatment used today. From antibiotics and blood transfusions to cut-
**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, C57BL/6J-Tg(Tra2-2), B6.Cg-Lepob/j, B6.129-TU2 Knockout (KO), B6-Wgag-TU2 Knockout (KO), B6.129-TU2 Knockout (KO), B6-TU2 Knockout (KO), B6.Lt-Cg-Lepob/j, and B6.129-TU2 Knockout (KO) mice per a C57BL/6 background as well as Single-Genie (SGS) rats.
- Housing and colony management of in vivo-deficient nude/SCID mice
- In vivo animal handling, experimental inoculations, tail vein and intraperitoneal IP injection, test substance dosing.
- Tail vein blood sampling (phlebotomy) and retro-orbital bleeding (under exterior anesthesia).
- Plasma glucose, insulin and triglycerides measurements.
- Tissue and organ collections, tissue dissection, and histology.
- Whole organs such as liver perfusion assay
- Phenotyping services to assess endocrine function and metabolite pathways using in vivo models of diabetes, obesity, and related metabolic complications
- Chronic and acute induction of obesity, insulin resistance and diabetes by leading high-fat diet, lipid infusion, streptozotocin injection and peritonitis treatment.
- Non-invasive arterial blood pressure assessment using tail-cuff ODA system.
- Clinical use of in vivo metabolic function tests and data interpretation including glucose tolerance tests (IP, IP and Oral GTT) and insulin tolerance test (ITT)
- High resolution ex vivo-paired gastric clamp to assess insulin sensitivity and glucose metabolism in awake mice and rats.
- Phenotypic analysis of in vivo skeletal muscle and peripheral blood samples
- Assessment of the effects of physical activity or voluntary exercise (mice) on energy balance and metabolism.
- 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 Various body/tissue composition of fat, lean and water mass.
- Use of roadway reducted 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 (mice) on energy balance and metabolism.
- Metabolic water mass.
- Insulin resistance challenge (Isolated perfusion protocol).
- Collection of post-stress plasma samples.
- Open field test.
- Forced swim test.
- Tail suspension test.
- Sucrose preference test.
- Social learning of food stimulus.
- Behavioral and cognitive assessments (Conditioned taste aversion, Conditioned place preference, Novel object recognition test).
- Drug trials finding studies on drug compounds and metabolic experiments.
- Helping investigations with designing relevant experiments, data analysis and interpretation.

**Endocrinology and metabolism (glucose, hormones)**
- Phenotyping services to assess endocrine function and metabolite pathways using in vivo models of diabetes, obesity, and related metabolic complications.
- Chronic and acute induction of obesity, insulin resistance and diabetes by leading high-fat diet, lipid infusion, streptozotocin injection and peritonitis treatment.
- 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 such as PPAR-β/δ/γ and ER/mitochondrial stress in metabolically important tissues such as adipose tissue, liver, skeletal muscle, and pancreas.
- Metabolic cages with temperature and light control.
- 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 Various body/tissue composition of fat, lean and water mass.
- Use of roadway reducted 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 (mice) on energy balance and metabolism.
- Metabolic water mass.
- Acute stress challenge (Isolated perfusion protocol).
- Chronically 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 stimulus.
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**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.
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- Drug trials finding studies on drug compounds and metabolic experiments.
- Helping investigations with designing relevant experiments, data analysis and interpretation.

**Research Sector**

- In vivo imaging of Luminiscence, Fluorescent, and CTA/MS.
- Clinical and academic pathology evaluation and reporting.
- Quarantine per diem services.
- Drug trial blinded studies of test compounds and metabolic experiments.
- Behavioral and cognitive assessments (Conditioned taste aversion, Conditioned place preference, Novel object recognition test).
- Drug trials finding studies on drug compounds and metabolic experiments.
- Helping investigations with designing relevant experiments, data analysis and interpretation.

- Research Sector
Microbiome and host response
- Plasma lipopolysaccharide binding protein (LBP) assay
- Gut permeability assessment using minocycline challenge and/or expression of tight junction proteins
- Inflammatory profiling and 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)
- Embryos and larval culture dissociated cell cultures, and microscopy
- Common manipulation including analgesia/anesthesia, injections, blood collection, necropsy, etc.
- Routine surgery and histology
- Behavioral tracking, and scoring/bathing of drugs or chemicals using zebrafish embryos
- Laser microinjection (manual)
- Molecular techniques including protein extraction from embryos for western blots (SDS-PAGE) and purification of DNA/RNA from zebrafish embryos (PCR/RT-PCR), extraction and purification of DNA/RNA from zebrafish embryos, in situ hybridization, total nucleic acid extraction from zebrafish embryos, Zebrafish DNA microarrays/GeneChip® zebrafish genome arrays, global gene expression analysis on pan-genome expression profiling using zebrafish oligonucleotide microarrays, and global microRNA (miRNA) expression analysis following drug treatment and/or dietary supplementation, induction of insulin resistance and development of type-2 diabetes, acute or chronic exposure to 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) radioluminescence imaging (RLI), optical imaging (depth resolved or planar fluorescence based on encapsulation ultrasonography), and most recently, multispectral optoacoustic tomography. There are processes for animal handling (e.g., anesthesia, injection, monitoring vital signs). AF staff can facilitate and undertake preclinical studies for implementation of new imaging protocols and evaluation of methods.

This Animal Facility has lab facilities on location and has computer capabilities for data analysis and image archiving.

Core leaders can advise researchers on:
- Experimentation 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
- Preparing 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 AAAUL to assure compliance with federal regulations, funding agency 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 of 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 Animal Care and Ethics Committee

Biomedical Research Departments
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. All the Genetics and Bioinformatics Department, available with various 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 genetics, 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 genotyping 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 complex 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 micro-RNA 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 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:

Statistical analysis of Proteomic data:
- Univariate or multivariate tests to establish associations between protein levels and the variable of interest, heatmap analysis, building of diagnostic models, and more.

RESEARCH SECTOR

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. All the Genetics and Bioinformatics Department, available with various 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 genetics, 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 genotyping 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 complex 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 micro-RNA 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 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:

Statistical analysis of Proteomic data:
- Univariate or multivariate tests 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 in advanced precision health which will sustain 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 the use of genetic 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 MiSeq
- Illumina HiSeq 2500
- Applied Biosystems 3730XL
- Applied Biosystems 7500
- Applied Biosystems 7500 FastSystem
- Auto-UPR-48 for HLA studies
- Tecan Freedom EVO Liquid Handling system
- Bravo, Agilent Liquid Handling system, G54004

Medical Sector

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
4. 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)
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 diabetic foot problems that, if implemented, will not only reduce patient outcomes but also reduce cost.

The DDI Podiatry Clinic provides specialized assessment and treatment for high risk patients with diabetic foot diseases ranging from preventative and early detection of patients, to identify, and treat existing problems such as foot ulcers and Charcot’s neuropathy, 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 assessment with patients, their families, nurses, medical students, physicians and other healthcare professionals. We collaborate in clinical research with many departments and institutions 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.
- SLT Lamp Examination - is a special microscope with light that lets the doctor examine the interior of the eye. At this time, the intraocular pressure will be checked, if needed.
- Visual Field Test - this test checks 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 (PRP) 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 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 whenever 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 (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 diabetes 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.

The Education & Training Department plans an essential part in education and health awareness of diabetes management to people with diabetes, students, healthcare professionals and the public. The CSC, an accredited CPO 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 (KWIS). The medical staff deliver Basic Life Support (BLS), Advanced Cardiac Life Support (ACLS), and other courses to medical students, healthcare professionals and the public. The CSC offers Internship Programs, as well as our various simulation courses.

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DAFNE Unit

One of our successful programs at DDI is DAFNE, which is a structured education program aimed at people with type 1 diabetes. DAFNE stands for Group Adjustment for Normal Eating, and it helps people manage and live well with their diabetes. DAFNE is an evidence-based educational program with over 80 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 16 years and above. Each course is run by two DAFNE educators who have expertise in diabetes and nutrition. Through structured education over 20 hours, participants learn how to calculate or estimate their carbohydrate intake for each meal and adjust their insulin dosage based on that, plus learning self-management skills to deal with diabetes, hypoglycemia, 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 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 sugars but also gave them the confidence to manage their diabetes better. Our program has followed in as part of this long-term education program. It helps participants live well with diabetes, aiming to allow them to lead as normal a life as possible and reduces the likelihood of long-term complications. In addition, DAFNE has shown improved HbA1c levels. DAFNE has also actively involved in research projects and scientific/academic activity of CO. CID participates with relevant 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, body and other internal structures of the body. A radiologist interprets these images to aid in the diagnosis and treatment of medical conditions.

Bone mineral densitometry (BMD) is a procedure 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 are equipped with a fully digital X-ray machine for a wide range of applications. A dedicated digital X-ray machine is also available to perform a complete jaw evaluation (Orthopantomogram-OPG).

Diagnostic Imaging Center

Diagnostic Imaging Center (DIC) of Dasman Diabetes Institute (DDI) offers advanced CT technology to our patients ensuring high quality of images while using the least possible radiation dose close to the body. We offer superior 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 makes a report.

D. X-ray

An X-ray is a common imaging test used by doctors to see inside the body. Although this test uses a small amount of radiation, the potential benefits outweigh the risks in most cases. DDD offers advanced CT technology to our patients ensuring high quality of images while using the least possible radiation dose close to the body. We offer superior advanced evaluation of kidney stones to facilitate specific treatment plans.

E. Vascular Lab

Functional (Phyiscal) testing is performed on the equipment provided by Doppler technology for patients with pain and arterial and venous blood flow problems in limbs (diabetes-related, venous ulcers, venous thrombosis etc.). A dedicated vascular lab is available in DIC to cater to patients, especially patients with diabetes, for their specific needs.
One of the main approaches in diabetes prevention is maintaining an optimal 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 diabetes and lifestyle professionals. The aim is to help people stay off diabetes and maintain their healthy lifestyle.

**Type 2 Diabetes**

Type 2 diabetes is diagnosed in people who do not produce or use insulin sufficiently. This type of diabetes is usually associated with being overweight or obese. Risk factors include family history of diabetes, age, ethnicity, and lifestyle factors such as lack of physical activity and a poor diet.

**Remission Clinic**

In this clinic, participants will be offered a tailored meal plan and individualized exercise programs. Medical care will be provided by a dietitian and a medical professional. This will help achieve the remission goals.

**DDI Diet Service**

For patients with type 1 and type 2 diabetes, we offer a tailored meal plan and individualized exercise programs.

**B. DDI Diet Service**

In addition, we are also offering our patients the very best care. Patients may need to improve their type 2 diabetes and even come off medications. To help achieve this, including total meal replacement products; low-carbohydrate, high-protein and low-calorie menus.

**Lifestyle & Wellbeing**

We offer several diets for achieving overall performance and progress. Patients or people with type 2 diabetes can select one of the meal plans to help improve their type 2 diabetes and even come off medications. To help achieve this, including total meal replacement products; low-carbohydrate, high-protein and low-calorie menus.

**Medical Fitness Center (MFC)**

The MFC is the ideal fitness center for people with diabetes. They receive a complete assessment by a dietitian and a medical professional. This will help us to give more accurate advice to our own patients and to improve their type 2 diabetes and even come off medications.

**Clinical Laboratories**

The Clinical Laboratories (CL) is one of the units in the Medical Sector, a K.A.C and GAP certified, offering high quality services to the public in Kuwait. The laboratory service is patients’ safety and quality of services; thus, the lab is under strict national and international quality assurance programs.

**Clinical Laboratory and Research**

Furthermore, C.L participate with the P.I. the required number and quantity of samples for their projects, other related and international projects processing the required clinical samples.
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