Natural & Medical Sciences
Research Center

مركز أبحاث العلوم الطبيعية والطبية
Natural & Medical Sciences Research Center

Towards Excellence in Chemistry, Biotechnology and Biomedical Research

EQUIPMENT BOOK

Sultanate of Oman - University of Nizwa

Oct 2018 (Edition 1)

Preface

Natural and Medical Sciences Research Center was established in 2010 at University of Nizwa. The center aims to create an innovation culture where the capacities are developed, collaboration and networking among researchers are fostered, scholarship and academic institutions are cultivated, and where innovation outcomes are geared toward social economic growth. The research outcomes of the center are demonstrated by the recent discoveries and the quality publications. Indeed, young scientists' development stands out among the useful achievements of the center.

The University of Nizwa has implemented plans that emphasize dynamic sequential initiatives for both internal as well as external funding. As a result, the university has built and furnished required research facilities and labs, recruited highly qualified researchers, and have capitalized effectively on its international network. The center has contributed effectively to funds rising through its funded projects of the interdisciplinary nature. The center has attracted external funds that exceed 5 million USD from different external sources including but not limited to Oman Research Council, Industrial Innovation Center, GCC CO-funding program and SQU-UoN CO-funding program.

The center comprises well-equipped research laboratories including Natural Products Laboratory, Marine Laboratory, Analytical Chemistry Laboratory, Synthetic Chemistry Laboratory, Drugs Discovery Laboratory, Drugs Design, Molecular Docking and Bioinformatic Laboratory ,Biotechnology Laboratory, Molecular Biology and OMICS Laboratory, Microbiology Laboratory ,Cell Culture Laboratory, Stem Cells Laboratory, Regenerative Medicine Laboratory,Nanomedicine Laboratory, Venomics and anti-venom Laboratory, In vivo Laboratory,Enzymology Laboratory. The center has supporting facilities including state-of- the-art core facility Fragrance Production Unit, Animal facility, Herbarium and Animal Resources Center.

While building up the research infrastructure, the university has in parallel recruited highly qualified Omani and international researchers with outstanding research profiles from world-leading institutes. The university has haired the full-time researchers and postdocs as a new practice for a focused research. In addition, the university realizes the importance of hiring qualified instrumentalists, instrumental engineers and well-trained technicians.

The active groups under the center have contributed immensely to the ranking of the university to place it the second in Oman and the first in "paper per faculty". Various projects have resulted in filing one patent, publication of 8 book chapters, many scientific reviews, many conference proceedings and more than 500 publications with thousands of citations.

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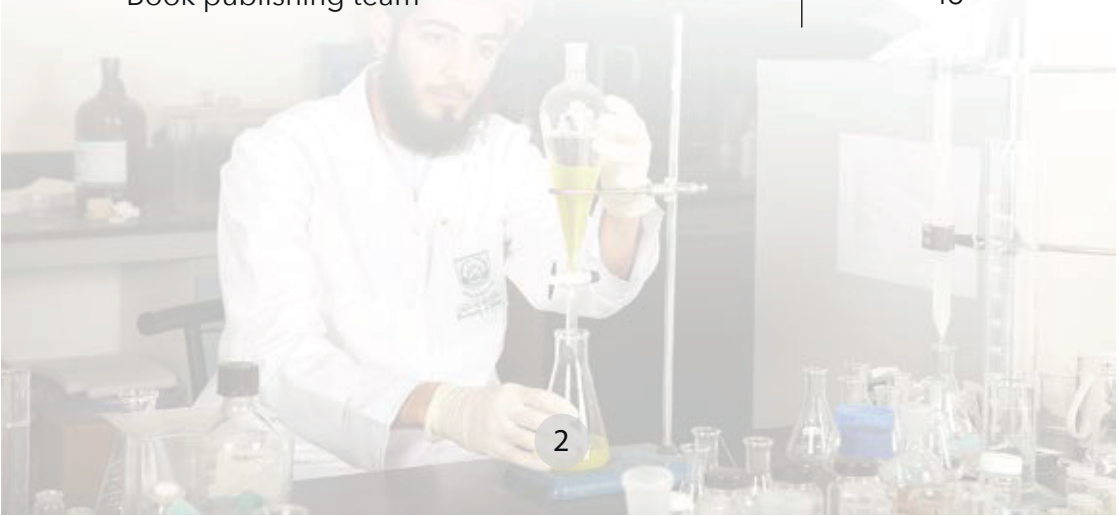
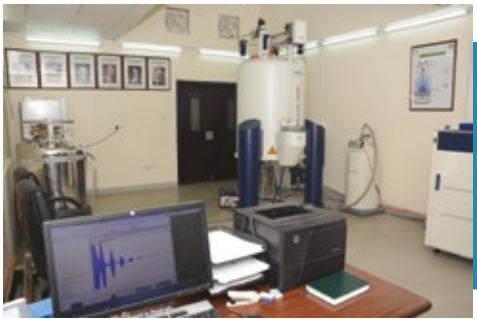
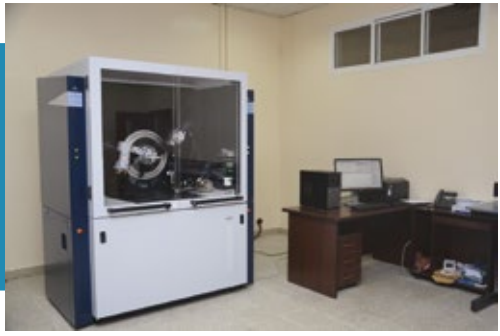


Natural products and Synthetic laboratories

Bruker Nuclear Magnetic Resonance (NMR) Spectroscopy:

is a research technique that exploits the magnetic properties of certain atomic nuclei. This spectroscopy determines the physical, chemical and biological properties of atoms or the molecules in which they are contained. There are more than 25 experimental techniques are being performed in our NMR.





Bruker X-ray Diffraction (XRD) * :

X-ray Diffraction (XRD) helps one to reach the science at atomic scale in the analysis of crystal structure, chemical composition, and physical properties of bulk and thin film crystalline or polycrystalline materials. XRD used to know crystallite size, lattice strain, chemical composition, and crystal orientation. While biological samples such as DNA, vitamins, protein, drug synthesis, use XRD to identify its elements and their crystal structure. It can also be used to identify arrangement of atoms in minerals, alloys, organic and inorganic complex compounds. Thus it has become the back bone of material characterization.

* Shared with National Chair of Material Science and Metallurgy

Agilent Technologies 6530 Accurate Mass Q-TOF LC/MS * :

The Agilent 6530 Accurate-Mass Quadruple Time-of-Flight (Q-TOF) LC/MS system features Agilent Jet Stream Thermal Focusing technology for significantly improved sensitivity, as well as enhanced Mass Hunter Workstation software for superior data mining and analysis capabilities. These new features, coupled with Agilent's True High-Definition TOF (True Hi-Def. TOF) technology, enable the 6530 Accurate-Mass Q-TOF to deliver exceptional sensitivity, excellent mass accuracy, fast data acquisition, and streamlined qualitative and quantitative analyses to meet your most challenging research needs.

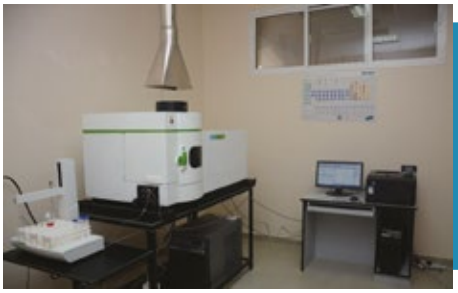
Bruker Single crystal X-ray diffraction * :

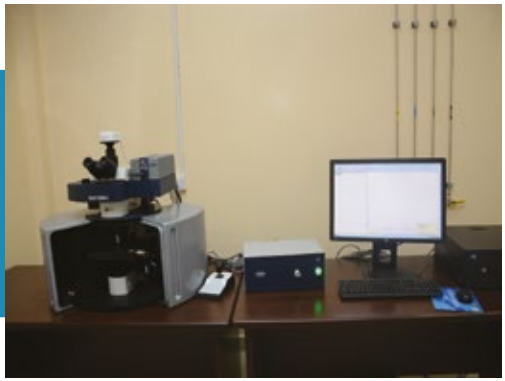
This is the most common experimental method of obtaining a detailed structure of a molecule, that allows resolution of individual atoms. Single crystal X-ray diffraction (SXRD) is performed by analyzing the pattern of X-rays diffracted by an ordered array of many identical molecule (single crystal). Many pure compounds, from small molecules to organometallic complexes, proteins, and polymers, solidify into crystals under the proper conditions. Computationally intensive analysis of a set images results in a solution for the 3D structure of the molecule.

* Shared with National Chair of Material Science and Metallurgy

PerkinElmer OPTIMA 8000Inductively Coupled Plasma Optical Emission Spectrometry ICP-OES * :

The widely used analytical technique for the determination of trace elements in a sample. Using the eponymous Inductively Couple Plasma, an ICP-AES produces excited atoms (by ionization in an intense electromagnetic field) that emit detectable amounts of light at characteristic wavelengths, with intensities proportional to the concentration of the ion. The intensity of this emission is indicative of the concentration of the element within the sample.

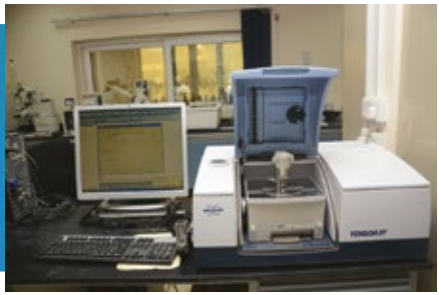




Bruker SENTERRA II Compact Raman Microscope * :

The SENTERRA II allows measuring Raman images and combines the obtained spatially resolved molecular information with high-quality microscopic images of the sample. The analysis is performed contactless and without the need of sample preparation. Chemical images of the sample surface can be achieved with a very high spatial resolution down to less than a micron. In addition depth profiling of optically transparent samples allows non-destructive sample investigation in the third dimension.

* Shared with National Chair of Material Science and Metallurgy



Bruker Fourier Transformer Infra-Red spectroscopy (FTIR; TENSOR 37) * :

FTIR used for the determination of functional groups in the pure natural products and pharmaceutical drugs. FTIR also used for the detection of heavy and essential elements in the medicinal plants, resins, and food products.

Automatic Preparative HPLC

Automatic Preparative HPLC used for the isolation of pure constituents from the mixture of two, three, and four compounds for samples soluble in chloroform (Solvent) only. This recycling HPLC system is being used in the isolation and purification of different types of natural products including enantiomers, diastereomers, epimers, positional isomers, and structurally related or unrelated compounds having similar retention characteristics.

* Shared with National Chair of Material Science and Metallurgy

Agilent Analytical HPLC (Agilent):

Analytical HPLC used for the qualitative and quantitative analysis of vegetables, medicinal plants and resins. It is also used for the standardization of drugs in pharmaceutical and industrial purposes.

JAI Preparative HPLC (Gradient Solvent System):

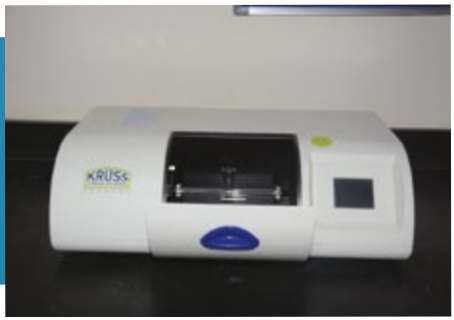
Preparative HPLC used for the isolation of pure constituents from the mixture of two, three, and four compounds for samples soluble in ethyl acetate or a mixture of ethyl acetate and n-hexane.

Cary 100 UV-Vis with S/W,

The Cary 100 is a cost-effective UV-visible spectrophotometer with a versatile set of accessories for routine laboratory work. It is controlled by the Cary WinUV software, a Windows-based software featuring an easy-to-use modular design. The instrument is shipped with liquid sample holders and can be fitted with a wide range of accessories to provide extra capabilities

PerkinElmer LS-55 Fluorescence Spectrometer (220 VAC)

Versatile, computer controlled Fluorescence spectrometer; incorporates a Watt (8.3 wati@220V), phosphorescence decay time measurements. Excitation 200-800 nm and emission 200-900 nm with zero order selectable. Standard PMT covers 200-650 nm; R928 or R955 PMT optionally available for full range.



Polarimeter:

It is used for the specific rotation of pure drugs, natural/synthetic products. This instrument will allow checking the optical purity of chiral compounds. it measure the angle of rotation caused by passing polorized light through an optically active substance.

Milestone New Microwave Essential Oil System (NEOS):

The NEOS system is based on the Solvent-Free Microwave Extraction technology for rapid extraction of essential oils from aromatic herbs, spices and dry seeds.

Kjeldahl Apparatus (KjelFlex K-360):

It is used for the quantification of nitrogen in terms of proteins in vegetables, medicinal plants and other formulations. Due to precision and reproducibility, it has become internationally recognized method for estimating the protein content in soils, waste waters, vegetables, medicinal plants, fertilizers and other food samples.

Moisture Analyzer:

It is used for the quantification of moisture in pharmaceutical drugs, medicinal plants and other formulations.

Melting Point Apparatus:

It is used for the determination of melting point of pure constituents and pharmaceutical drugs.

Microwave Synthesis Reactor (MSR):

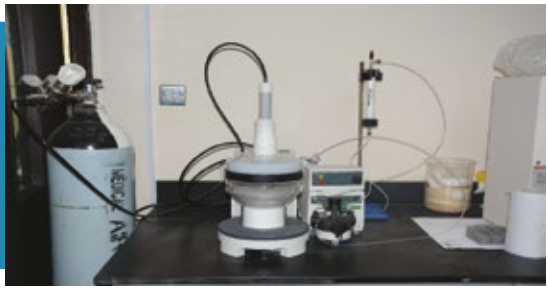
MSR used for quick, fast, low cost and environmental friendly synthetic reactions using microwave radiation instead of heat. It provides a completely new and sophisticated approach towards microwave synthesis. Not only polar solvents but also commonly used poor microwave absorbers, such as toluene or dioxane, can be used successfully in high-temperature microwave protocols

Buchi Rotary Evaporator:

It is used for the quick evaporation of organic solvents.

Karl Fischer Coulometric Titrator:

Classic titration method in analytical chemistry that uses coulometric or volumetric titration to determine trace amounts of water or water content in organic solvents.

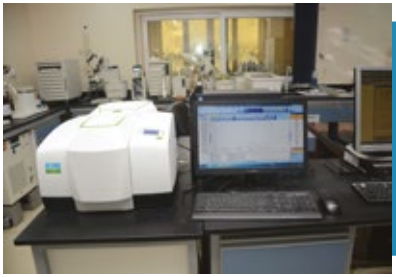


Buchi Medium Pressure Liquid Chromatography (MPLC):

MPLC used for the quick separation of a mixture of two, three and four compounds using pressure pump with gradient solvent system.

Perkin Elmer Near Infra-Red (NIR):

NIR used for the qualitative and quantitative analysis of vegetables, medicinal plants and resins as well as adulteration in milk, milk powder, petrol, diesel etc. It is also used for the adulteration of pharmaceutical drugs. It is fast, sensitive, non-destructive and friendly technique.



Differential Scanning Calorimeter (DSC)

DSC measures temperatures and heat flows associated with thermal transitions in a material, including glass transitions, "cold" crystallization, phase changes, melting, crystallization, product stability, cure / cure kinetics, and oxidative stability. Applications: Common usage includes investigation, selection, comparison and end-use performance evaluation of materials in research, quality control and production applications

Particle size analyzer

The Cilas 1190 is a versatile instrument with a measurement interval of 0.04 microns (40 nanometers) to 2,500 microns. It uses two techniques for its measurement: Laser Ray Diffraction and digitalization with a CCD Camera that measures large sizes. This instrument uses 3 laser beams for its measurement process, 2 which do the same function of a Cilas 1090 and the other laser for the process with the CCD camera.

Texture analyzer

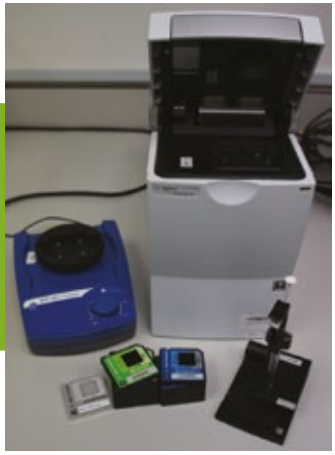
The CT3 can calculate, through compression and tensile data, a number of physical properties that have proven to be highly correlated to human sensory evaluation of food and other consumer products.

Biotechnology and OMICS laboratories

Next Generation Sequencing set-up *:

It includes IonS5, emulsion PCR, library size selector and genomic work bench server. It can do 200bp, 400bp and 600bp insert size, 60-80 million reads, 10-15 Gb data output per run of about 2 to 3hrs. It is used for microbial (bacteria, fungi), plant and human whole or partial genomics. It is used for Organelle genomes (chloroplast, mitocondria), metagenomics (soil, water, plant, animal, human), DNA methylation/mutation studies, and transcriptomics. In addition, it is used for pathogenic infections, public health, food safety and exome sequencing.

* In collaboaration with Oman Animal Plant Genetic Resources Center (OAPGRC)



Bioanalyser 2100:

With automated electrophoresis, provides sizing, quantitation, and purity assessments for DNA, RNA, and protein samples. It can be used for DNA/RNA fragment analyses for NGS sequencing. It can do QC, size distribution, PCR validation, restriction digestion, protien expression, food analysis, cleavage/mutation detection, vector assembly analysis, microarray etc.

DNA 120 OP:

These complete systems provide everything needed to quickly dry and concentrate small sample volumes in one fully integrated package. It has a single program that supports all DNA/RNA applications; For evaporating PCR buffers (aqueous); Water and Ethanol from DNA/RNA samples.

QuantStudio™ 5 Real-Time PCR System:

The QuantStudio™ 5 Real-Time PCR System is an ideal high-performance instrument with features for maximum experiment control. Applications including gene expression analysis, microRNA analysis, single nucleotide polymorphism (SNP) genotyping, copy number variation (CNV) analysis, and even protein analysis. This versatile technology can be used for both relative and absolute quantification methods. Protein Assays combine the sensitive, specific protein-binding capabilities of antibodies with the superior relative quantitation capabilities of 5' nuclease real-time PCR. In addition, it can do multiplex gene expression; pathogen detection and antibiotic resistance screening; miRNA quantification and analysis; and screening annealing temperatures for rare allele detection.

PCR System (Applied Biosystems USA):

We have three advanced and normal PCR systems. ProFlex PCR System has 3 x 32-well block option can run three different cycling conditions (0.2 mL/ 6.0°C/sec). Three different cycling conditions, at three different times by one or multiple users, so it can help to reduce time in optimization of protocol. This can be monitor remotely for different runs from smartphones or desktop computers. SimpliAmp PCR system is 96-well 0.2 ml with 3-zone VeriFlex Blocks 96 reactions; 4.0°C/sec; Touch screen; efficient and accurate; cloud based technology. GeneAmp®PCR System 9700 is a 96-well 0.2 ml and can do 96 reactions. It is used DNA amplification, Genetic diversity, Microbial identification, Pathogenic identification, Genomic sequencing, Genotyping, Cloning, Mutation detection, microarray and forensics.

Qubit™ 3.0 Fluorometer:

is the next generation of the popular benchtop fluorometer that accurately measures DNA, RNA, and protein using the highly sensitive quantitation assays. The concentration of the target molecule in the sample is reported by a fluorescent dye that emits a signal only when bound to to the target, which minimizes the effects of contaminants—including degraded DNA or RNA—on the result. It uses as little as 1 µL of sample.

Object Scan 1600 *

It is a workstation consisting of ObjectScan 1600 scanner, ScanWizard_Botany software, and MiVapp_Botany archive management system. This integrated workstation is characterized by, (1) On-top scan design for full-frame focus, (2) 1600 dpi (equal to 1 Gigabyte pixels) color CCD, (3) Optical Character Recognition (OCR) for specimen label and 1D barcode, and (4) image archive and privileged-account cloud management system

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Fermentor:

(BioFlo 320, next-generation bioprocess control station ; Eppendorf USA) is a Research and development in cell culture and microbiology; Bench- and pilot-scale fermentation of aerobic and anaerobic bacteria, yeasts, and fungi; Cultivation of mammalian, insect, and human cell lines; Specialized applications such as stem cell culture or biofeul/biopolymer development; Specialized packed-bed impeller for vaccine production in anchorage and non-anchorage dependent cell lines; Suitable for batch, fed-batch, and continuous processes; Biotransformation of secondary metabolites by microbes and Bioremediation strategies.

The ZOOM® IEF Fractionator kits:

Offers a fast, reliable method to reduce sample complexity, enrich low abundance proteins, and increase the dynamic range of detection. Solution phase isoelectric focusing with the ZOOM® IEF Fractionator provides reproducible separations in three hours. Fractionated samples are ready for further analysis by two dimensional gel electrophoresis (2DE), one dimensional gel electrophoresis (1DE), or two dimensional liquid chromatography/mass spectrometry (2D LC/MS).

Class II, Type A2 Biological Safety Cabinets:

Biological Safety Cabinets designed to protect personnel, product, and the environment from exposure to biohazards and cross contamination during routine procedures. Class II cabinet works with low to moderate risk biological agents. The existing cabinet also included UV light to keep a biosafety cabinet's interior clean when not in use.

xMark Microplate Absorbance Spectrophotometer (Biorad, USA) :

Is used for Enzyme-linked immunosorbent assay (ELISA), which can run 6- to 96 samples with wave length 200–1,000 nm and single and dual wavelength. It is used for enzyme inhibition assay and kinetics (Urease, a-Glucosidase, Acety cholenisterase; a-Amalyase, etc), anti-oxidant quantification; OD600; protein quantification; various colorimetric assays for microbiology, plant physiology, and biochemistry.

Denaturing gradient gel and Electrophoresis systems:

A set-up of DGGE is helpful for microbial diversity analysis in various samples from soil, water and plants. The electrophoresis system are both vertical and horizontal, which can run from 8 to 96 samples in one go.

Autoclave (SX 700E; Tomy; USA):

It is vertical top-open led autoclave about 550 L. It can run 25 to 250 ◦C with 7 different programs. It is used in microbiology and molecular biology and sterilization of microbial media.

Refrigerated centrifuge (ProScientific):

It can operature with various programable options. The centrifugation range is from 500 to 15,500 rpm with volume ranging from 0.2 ml to 50 mL. It is used for DNA/RNA and Protein extractions.

Digital Heating Shaking Drybath:

Speed range from 150 to 1500rpm (block dependent); 0 programs, up to 10 steps per program; 150 to 1,500rpm (96-well block); 150 to 1,200rpm (0.5mL, 1.5mL and 50mL tube blocks).

Thermo Scientific Heraeus Pico 17 microcentrifuge:

Performance up to 17,000 x g with fast acceleration and deceleration. Standard rotor runs 24 microcentrifuge tubes in a single row, from 1.5 to 2.0 mL tubes to mini-preps and spin columns.

Tissue homogenizer:

It is used for grinding and homogenization of soft and Hard Tissue for cellular, biological; and DNA/RNA and Protein extractions.

Gel-Drier (LabTech):

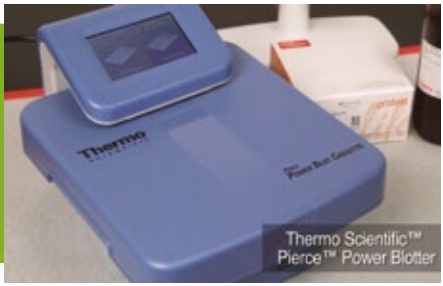
It has microprocessor control temperature and timer dryer (85 ◦C) and can dry gels 10 x 10 cm size.

Gel Documentation System:

It used for gel documentation, fitted with Pre-focused 5 mega pixel monochrome camera and Interchangeable filter slide with 620nm. It is used for DNA/RNA/Protein gel electrophoresis analysis.

Fisher Scientific™ Bead Mill 24 Homogenizer:

Used for variety of applications that require grinding, lysing, and homogenization of biological samples prior to molecular extraction: DNA/RNA extraction, tissue homogenization, protein purification.



The Thermo Scientific™ Pierce™ Power Blotter:

Is designed specifically for rapid semi-dry transfer of 10-300 kDa proteins from polyacrylamide gels to nitrocellulose or PVDF membranes in 5 to 10 minutes. The Pierce Power Blotter features an integrated power supply optimized to enable consistent, high-efficiency protein transfer when used with commonly used precast or homemade gels (SDS-PAGE).

The Mini Gel Tank:

Is compatible with a variety of Novex® gels, NuPAGE® gels, and Bolt® Bis-Tris Plus gels. Each Mini Gel Tank can accommodate up to two gels per run. The unique tank design enables convenient side-by-side gel loading and enhanced viewing during use. SDS-PAGE analysis for proteins.

Bioinformatics Server, Lenovo P910 Workstation:

It is a 2 x Intel Xeon E5-2650 v4 Processor (30MB Cache, 2.20GHz; 22 core processor), 384GB RAM (12 x 32GB 2400MHz ECC RDIMM 12) 2 x M.2 512GB PCIE SSD, and 4 x 4TB Hard Drive. It is used for de novo assembley, genome mapping, and various bioinformatic analysis to analyze genomic and transcriptomic dataset. It uses online available modules/suits as well as CLC genomic workbench for sequence analysis.

Dell Precision 7910 Tower Workstation:

For molecular docking, drug discovery and protein-ligand interaction server with 4 cores running at 3.1Ghz and 96GB RAM for simulations and modeling.

Supporting instruments

Cold storages (SANYO; LG):

It ranges between -80 ◦C (600 L); -20 ◦C (500 L); 4◦C (550 L) fridges for keeping samples for long-term uses and experimentation.

Freeze-Drier (LabTech):

It is vacuum-Freezing (-56 ◦C), which can be used to freeze-dry samples for phytochemical, microbiology and antioxidant analysis. Its sample volume ranging from 0.1 to 1000 uL; 1 to 100 mL volumes; 1.0 mg to 250g.

Ultra sonicator Elmasonic P:

Special functions such as Sweep, Pulse and Degas can be individually activated and complete the equipment.

Supporting instruments

Vertex:

Touch and manual vertexing for volumn ranging from 0.1 to 1000 uL; 1 to 50 mL volumes. The rotation can range to 1500rpm.

Ice maker (LabTech):

It makes flakes with an out-put ranges between 1 to 2 Kg per hour.

Table top centrifuge:

Machines for root temperature centrifugations. For RNA/DNA extractions.

Incubators:

3 different incubators are currently available with different experimental prospects. The size of these incubators ranging from 30 l to 60L and can run 25 to 85 ◦C.

Supporting instruments

Incubators and open Shakers (Korea):

Open and closed incubator shakers are used to growth microorganisms. The capacity range from 50 ml to 2.5 L and can run on 300 rpm; orbital/reciprocal with a temperature of 25 to 55 ◦C.

Dry Bath (Cleaver Sci):

Dry heating block which control temperature from 37 to 150◦C and volumn ranges from 1.0mL to 50mL.

HANA pH and electrical conductivity meters:

Wide ranges of pH meter for biotech, omics and microbiology parts.

Biomedical science laboratories

IVIS Lumina XRMS In Vivo Imaging System:

It includes IonS5, emulsion PCR, library size selector and genomic work bench server. It can do 200bp, 400bp and 600bp insert size, 60-80 million reads, 10-15 Gb data output per run of about 2 to 3hrs. It is used for microbial (bacteria, fungi), plant and human whole or partial genomics. It is used for Organelle genomes (chloroplast, mitocondria), metagenomics (soil, water, plant, animal, human), DNA methylation/mutation studies, and transcriptomics. In addition, it is used for pathogenic infections, public health, food safety and exome sequencing.

Individually Ventilated Cages (IVC):

The purpose of IVC system is to provide a clean environment that is generally suitable for breeding and preservation of Specific-pathogen-free (SPF) animals. This type of environment support various animal experiments especially in the use of immunodeficiency animals.

Guava® easyCyte Flow Cytometry:

Flow cytometry is a technology that is used to analyze the physical and chemical characteristics of particles in a fluid as it passes through at least one laser. Cell components are fluorescently labelled and then excited by the laser to emit light at varying wavelengths. This flow cytometry is simpler to operate than traditional sheath-fluid based in instruments and are easier to maintain. The utilize small sample volumes and generate minimal waste a result of Guava® easyCyte flow cytomer are uniquely amenable to on-demand use in the laboratory environment and have helped many scientists achieves insightful cellular analysis. Sample Handling Formats for Both Tubes and 96-Well Plates.

CO2 incubators:

Cell culture incubator is designed to maintain a constant temperature and high humidity for the growth of tissue culture under a CO2 atmosphere. The temperature settings is 37°C and the CO2 concentrations set at 5%. This incubator has also decontamination system that can be used from time to time to obtain a clean environment for the cells. CO2 incubator is a fundamental instrument for growing cells in optimal condition.

Class II, Type A2 Biological Safety Cabinets:

Biological Safety Cabinets designed to protect personnel, product, and the environment from exposure to biohazards and cross contamination during routine procedures. Class II cabinet works with low to moderate risk biological agents. The existing cabinet also included UV light to keep a biosafety cabinet's interior clean when not in use.

Inverted and fluorescence microscope with camera:

A fluorescence microscope is an optical microscope that uses fluorescence in addition to reflection and absorption to study properties of organic or inorganic substances.

Reptile cages and Bird cages:

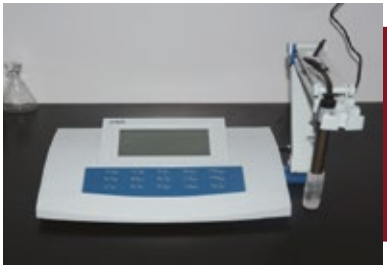
Different types and sizes of cages used as a suitable environment of living snakes and other reptile.

Centrifuges with different tubes volumes:

Machine with a high speed rotating rotors that applies centrifugal force to its contents, to separate fluids of different densities or liquids from solids.

PH meter:

is an instrument that measures the hydrogen-ion activity in water-based solutions, indicating its acidity or alkalinity. The pH meter is used in many applications ranging from laboratory experimentation to quality control.



Liquid nitrogen supply and storage tanks:

Liquid nitrogen is a cryogenic fluid that can cause rapid freezing on contact with living tissue and has a boiling point of –196°C. It used to store cells at low temperature for laboratory work.

Venoms freeze dryer:

Freeze dryer or lyophilization or cryodesiccation is the removal of solvents from a material through the process of sublimation and the removal of bound water molecules through the process of desorption. This make material more convenient for transport and better for long time storage.

Instruments in collaboration with Daris Center

Transmission Electron Microscope (TEM)

JEOL JEM-1400 TEM with 3D Tomography System

The JEOL JEM-1400 TEM is an ultra-high magnification instrument offering state-of-the-art high contrast imaging up to x1,200,000 magnification with a high resolution of up to 0.2 nm for observing the internal structure (ultrastructure) of a specimen in micrometer (μm) and nanometer (nm) ranges. The system has the capability of exporting data to a dedicated tomography system for 3D structural elucidation. The specimen chamber has the capacity to load five samples at a time, 1mm3 biological samples are sliced into ultrathin sections from 60-90nm thickness using an ultramicrotome and then loaded onto Formvar carbon coated grids.

Scanning Electron Microscope (SEM)

JEOL JSM-6510LA SEM with SED, BSD, and EDS detectors

The JEOL JSM-6510LA SEM is capable of high magnification for observing the surface structure (topography) of a specimen in micrometer (μm) and nanometer (nm) ranges. The magnification is variable from x10 to x300,000 with a resolution of up to 3 nm. Unlike conventional light microscopes the SEM uses a beam of electrons to scan the sample; the reflected electrons are then detected using different types of detectors to create a 3D image in grey scale.

High Performance Liquid Chromatography- Ultra Violet detection (HPLC-UV)

Liquid chromatography UV detection is an analytical technique where by certain non-volatile group of compounds can be analyzed using the Ultra Violet (UV) detection to identify and quantify compounds of interest. This system is one of the most common instrumentation in the majority of the analytical laboratories around the world. This is mainly due to the fact that the instrumentation is relatively cheap to acquire and easy to use with minimal training for the staff. As with LC-MS this instrumentation has a wide range of uses and is applicable to compounds such as pesticides, pharmaceutical products, drugs of abuse and many other categories.

Liquid Chromatography- Mass Spectrometry (LC-MS)

Liquid chromatography–Mass spectrometry (LC-MS, or alternatively HPLC-MS) is an analytical chemistry technique that combines separation capabilities of liquid chromatography (or HPLC) with the mass analysis capabilities of mass spectrometry (MS). LC-MS is a powerful technique that has very high sensitivity and selectivity and as such is useful in many applications. Its application is wide ranging from detection of pesticides in water, blood, soil to analysis and identification of medicine and chemicals used in pharmaceutical industry, Forensic science, Hospitals.

Gas Chromatography – Flame Ionization Detector (GC-FID)

Gas chromatography with Flame Ionization Detector (GC-FID) is a common type of chromatography used in analytical chemistry for the separation and analysis of multi-residue samples that can be vaporized without decomposition. The sample migrates through the column with a flow of inert or unreactive gas, which is called the carrier gas. The mechanism of separation is influenced by many factors, for example, the components, which have low boiling points, will come out of the column earlier and will be detected faster than those that have high boiling points.

Linearity and detection ranges: FIDs can measure organic substance concentration at very low and very high levels, having a linear response of 10^6.

Gas Chromatography – Mass Spectrometry (GC – MS)

Gas chromatography–mass spectrometry (GC-MS) is an analytical method that combines the features of gas-liquid chromatography and mass spectrometry to identify different substances within a test sample. GC-MS has been widely heralded as a "gold standard" for forensic substance identification because it is used to perform a specific test. A specific test positively identifies the actual presence of a particular substance in a given sample. A non-specific test merely indicates that a substance falls into a category of substances. Although a non-specific test could statistically suggest the identity of the substance, this could lead to false positive identification.

Atomic Absorption Spectroscopy (AAS)

Atomic absorption spectroscopy (AAS) is a spectroanalytical procedure for the quantitative determination of chemical elements using the absorption of optical radiation (light) by free atoms in the gaseous state. In analytical chemistry the technique is used for determining the concentration of a particular element (the analyte) in a sample to be analyzed. AAS can be used to determine over 70 different elements in solution or directly in solid samples used in pharmacology, biophysics and toxicology research.

Inductively Coupled Plasma - Mass Spectrometry (ICP-MS)

Inductively coupled plasma mass spectrometry (ICP-MS) is a type of mass spectrometry which is capable of detecting metals and several non-metals at concentrations as low as one part in per trillion. This is achieved by ionizing the sample with inductively coupled plasma and then using a mass spectrometer to separate and quantify those ions. Compared to other atomic absorption techniques for example, Atomic Absorption Spectroscopy, ICP-MS has greater speed, precision, and sensitivity. However, analysis by ICP-MS is also more susceptible to trace contaminants from glassware and reagents. One of the largest volume uses for ICP-MS is in the medical and forensic field, specifically, toxicology. A physician may order a metal assay for a number of reasons, such as suspicion of heavy metal poisoning, metabolic concerns, and even hepatological (liver related) issues.

Services and contact details

Natural and Medical Sciences Research Center provides research opportunities and analytical services for different beneficiaries including academia, public and private sectors as well as industry.

Samples submission forms are available upon request
1. Submission form internal (Staff and students of university of Nizwa)
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For any further details on type of services and cost, please contact us:

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