

Natural and Medical Sciences Research Center (NMSRC)



Center Overview



His Majesty Sultan Qaboos bin Said
May Allah rest him in the abodes of the pious and righteous in Paradise.

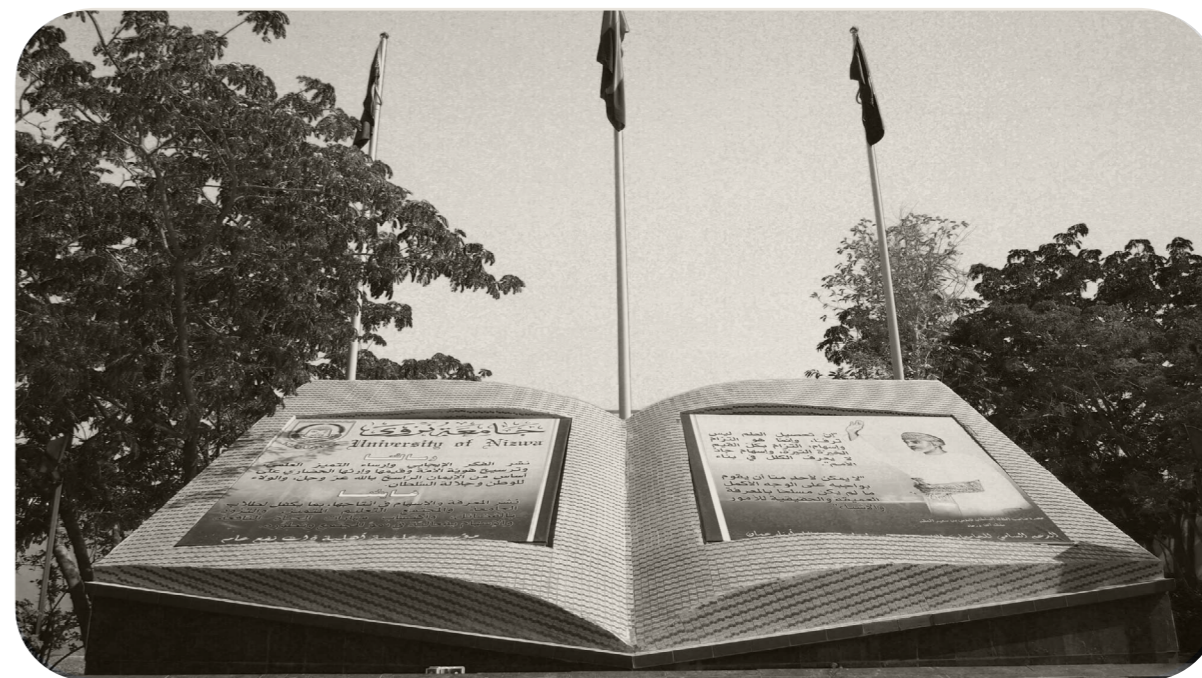


“We have always stressed the importance of science and knowledge and keeping pace with their developments with all possible means, with active brain, on the bases of thinking and experience”.

His Majesty Sultan Haitham bin Tarik Al Said



“On top of our national priorities is the education sector, with all its types and levels. It will receive full attention, and it will be provided with the supporting environment which motivates research and innovation”.



Center Overview



Preamble

The University of Nizwa has created the Natural and Medical Science Research Center as a vital vehicle in delivering its research strategy's objectives among other means including research teams and research centers. This Center focuses on medicinal plants and marine natural products. Indeed, it comes as a direct response to the research strategy of the Sultanate of Oman that aims at creating an innovation culture where capacities are being built, collaboration and networking among researchers, scholars and institutions are being forged, and where innovation outcomes are transformed toward social economic growth. This new Center embodies all those noble objectives.

This five-year program is set to further build on Omani excellence in the chemistry, pharmacognosy, pharmacology, spectroscopy, molecular biology, microbiology and plant physiology and taxonomy. All of which are of immense economic potentials. No doubt, this Center will boost knowledge transfer, enhance Omani human resources building and strengthen scientific bridging between Oman and other countries.

The Center shall cater to various needs of the country in basic as well as applied and specialized areas of natural products research and education related to the Center scope of activities. The University of Nizwa (UoN) envisioned this Center and drew necessary implementation plans that emphasized dynamic sequential implementations and both internal as well as external funding. As a consequence, the UoN built and furnished required research facilities and labs, recruited highly qualified researchers and capitalized effectively on its international networks.



Acknowledgement

I am grateful to all of those with whom I have had the pleasure to work and who contributed immensely to drive our teamwork to success. In this regard, I would like to thank our highly dedicated team who made our center a great success. I am indebted to the chancellor of the University for his encouragements and unlimited support as well as personal and professional guidance in all aspects. Moreover, I thank the Vice Chancellor for Academic Affairs and VC for Finance and Administrative Affairs for their invaluable support. The achievements and activities presented in this book wouldn't have been possible without the generous support from the University of Nizwa which is reflected in recruitment of researchers, support of PhD students, building and furnishing the research laboratories and acquiring capital equipment. The support of the External Relations office with regard to MOUs and students exchange program is highly acknowledged.

I highly value the remarkable contribution of the Oman Research Council TRC for funding several projects through Open Grants and FURAP projects. I also thank Industrial Innovation center for its efforts to link some of our innovative projects with industry which was a great success. I am grateful to OAPGRC for the generous support and to PDO for funding NGS. I also thank Oman LNG and Al Mouj for funding some equipment and events. The gene bank of Oman is a major addition to the Sultanate to protect our genetic resources which is a joint initiative with OAPGRC, I therefore thank them for choosing our center to be a partner.

I am indebted to our local and regional collaborators who participated in several projects. In this regard I thank SQU, Qatar University, Qatar Foundation and Kuwait University for the joint projects through bilateral agreements with these universities. I am also thankful to our international partners and collaborators for the successful joint projects that have resulted in high impact publications.

Finally our team and I were working hard not only during the working days but outside the working hours and in weekends, I therefore thank our families for their understanding and patience.

Ahmed Al Harassi

Prof. Ahmed Al-Harassi
Chairman, NMSRC



Introduction

The University of Nizwa (UoN), as an entrepreneurial, civic, and outreach University, has set its objectives, mission and vision to become a global hub for research, and contribute effectively in Oman's economy. The University Charter "recognizes research as a major constituent of the University towards the establishment of a rich culture of innovation and creativity". Core values governing the mission of the University provide scientific research full support for knowledge acquisition and enhancement of the interactive role of the University. The University has developed a comprehensive research strategy that is aligned with the University's strategic mission and the national research strategy of The Research Council (TRC). The University has quantified three major research components: research infrastructure, funding, and human resources to produce effective research development. In addition to the research strategy, the UoN has a research operational plan in place, to effectively manage research activities and resources across the campus.

The University has created the Natural and Medical Sciences Research Center (NMSRC) as one of the means to deliver its research objectives. This successful project is a consortium of distinguished scholars with multidisciplinary scientific backgrounds including marine chemistry and biology, medicinal phytochemistry, analytical chemistry, organic synthesis, catalysis, polymer chemistry, computational chemistry, fragrance chemistry, spectroscopy, X-ray crystallography, mass spectrometry, NMR spectroscopy, microbiology, plant physiology, structural and molecular biology, biotechnology, tissue culture, genomics, proteomics, enzymology, cancer biology, stem cells, regenerative medicine and tissue engineering. The NMSRC possess state-of-the-art laboratories in the aforementioned areas.

The NMSRC is pioneered and sustained by skillful young Omani scientists who obtained the required qualification to become future leaders in the above areas. Funding is sustained through different internal and external programs. Moreover, the NMSRC has liaised with local government organizations and industries whereby new innovative projects have been funded jointly. The NMSRC has also capitalized effectively on its international collaboration network that is evidenced by more than fifty active international collaborations worldwide. The research outcomes are evidenced by more than 500 publications in reputable journals including patents, original papers, reviews, book chapters, books and conference proceedings.



Foreword by His Highness



His Highness
Sayyed Asaad bin Tariq Al Said
Chairman of the Board of Trustees
University of Nizwa

The University of Nizwa is highly committed in realizing its vision to be a beacon of Knowledge and Enlightenment. Such commitment indeed can be attained only through emphasis on research and research-led learning. To that end the UoN has geared up its effort to be a conducive research environment, hence the Natural and Medical Sciences Research Centre (NMSRC) was established.

This research centre along with other specialized chairs and centres provide needed platforms that support a wide spectrum of vital areas which shall secure Oman's economic growth and further development. The NMSRC is a case in point that reflects UoN research strategy which is a direct response to the research strategy of the Sultanate of Oman that aims at creating an innovation culture where innovation outcomes are transformed toward social economic growth which is in alignment with the Sultanate's strategy to diversify its economic resources.

The NMSRC with its ten years of research excellence in natural and medical sciences embodies all those objectives. The NMSRC at the University of Nizwa has emerged to be a leading research centre in the Sultanate given its research infrastructure, state-of-the-art facilities, large network of local and international collaborators, skilful and creative professionals, multidisciplinary nature of its projects and high impact publications.

It has played and continues to play a significant role to provide expert opinions to some challenges facing the Sultanate by providing solutions and services to the government and industrial stakeholders. Given the size of the research topics and infrastructure, the NMSRC is expected to be a leader in promoting the growth of science and technology and shall nucleate a robust foundation for a research-led learning.

This comprehensive report introduces the reader to the research projects and activities being conducted by the NMSRC and shall serve as a reference to both academia and industries. I congratulate the centre for their outstanding achievements and breakthroughs and look forward to their future achievements.



Message from the Chancellor



Professor Ahmed Al-Rawahi
Chancellor, University of Nizwa

Recently, the world-leading economies have been transformed into knowledge-based economies. In such systems, "knowledge and talent" workers are becoming a major component of their workforce; and the knowledge-production/institutions are becoming critical drivers of the wealth transfer and prosperity making of those evolving societies. Indeed, the future economies will witness greater changes in the role of the different components of the wealth making process. For all these reasons, research institutions will be the key for economic development of the future societies. Accordingly, the Research Strategy of the Sultanate envisions mobilizing Oman's economy to become among those that are knowledge-based and knowledge-driven.

This research centre along with other specialized chairs and centres provide needed platforms that support a wide spectrum of vital areas which shall secure Oman's economic growth and further development. The NMSRC is a case in point that reflects UoN research strategy which is a direct response to the research strategy of the Sultanate of Oman that aims at creating an innovation culture where innovation outcomes are transformed toward social economic growth which is in alignment with the Sultanate's strategy to diversify its economic.

The University of Nizwa, as an entrepreneurial, civic, and outreach university, has set its objectives, mission and vision to become a major player, locally and regionally, in knowledge production, knowledge transfer and knowledge dissemination. With such a role, UoN will contribute effectively in Oman's economy along with other institutions. To achieve its full potential requires greater attention to human capacity building especially of faculty and staff who are entrusted with such responsibility. In addition, financial resources must be developed to ensure effective attainment of such potential.

Research chairs and centers have been recognized as an effective vehicle for the delivery of multidisciplinary research. Hence, the creation of the Natural and Medical Sciences Research Center (NMSRC) comes as the first step by UoN to realize its research strategy.



Message from the Chairman



Professor Ahmed Al-Harrasi
Vice Chancellor for Research, Graduate
Studies and External Relations
and Chairman of NMSRC

The University of Nizwa (UoN) has implemented plans that emphasize dynamic sequential initiatives for both internal as well as external funding. As a result, the UoN has built and furnished required research facilities and labs, recruited highly qualified researchers, and has capitalized effectively on its international networks. The University of Nizwa has created the Natural and Medical Sciences Research Center (NMSRC) as a crucial vehicle in delivering its research strategy's objectives among other means including research Chairs and research groups. NMSRC focuses on research development pertaining to Natural and Medical Sciences to build upon Omani excellence in chemistry, biology and medicine. Indeed, young Omani scientists' development stands out among the major achievements of the Center. Drugs discovery from Omani natural resources including medicinal plants, marine sources and microorganisms has received and will continue to receive great emphasis due to their immense economic potential and importance.

It is my intent to accelerate the knowledge transfer, enhance Omani human resources development, and promote scientific exchange and cooperation between Oman and other countries, the fact that is evidenced by the large network of local and international active collaborators the center has signed several agreements with. I shall continue to cater to the various needs of the country related to the aforementioned mentioned specialized areas.

NMSRC has managed to create an innovation culture where capacities were developed, collaboration and networking among researchers were fostered, scholarship and academic institutions were cultivated, and where innovation outcomes are geared toward social economic growth. More than 600 publications, patents, book chapters and books demonstrate the research outcomes of the Center.

This research summary intends to highlight the discoveries and research activities of the Natural and Medical Sciences Research Center.

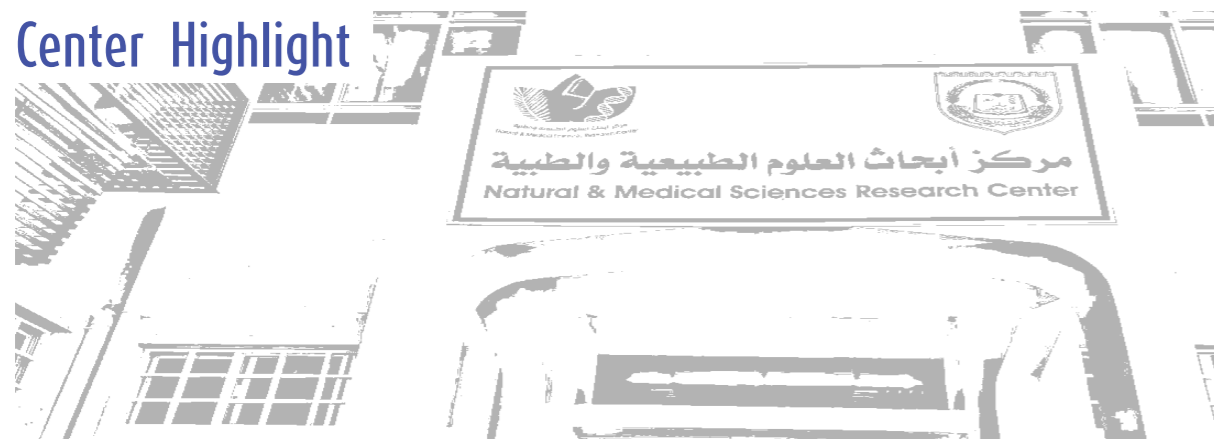


Objectives

- Introduce a high-quality research and development program through the support of active international collaborators.
- Develop research capacities, build up and produce highly qualified personnel.
- Create and manage intellectual property that shall lead into the development of new products and spin-off businesses.
- Establish contacts and networking with national and international academic and industrial organizations.
- Develop and implement new teaching curricula, degree programs at the undergraduate and graduate levels.
- Assist and advise for the development of needed processing and manufacturing plants in the field of natural products, thereby creating more jobs for Omani graduates and enhancing the economic growth.
- Provide relevant expertise to government agencies of the Sultanate of Oman.
- Conduct scientific research and studies concerned with the progress of national industry and which facilitates the correct use of medicinal plants.
- Encourage the practice of scientific research and nourish the spirit of research in the younger generation.
- Explore and study medicinal plants and marine natural products for maximizing their economic, social and ecological returns to Oman.



Center Highlight



A library of compounds has been generated comprising more than 600 natural and synthetic compounds with their NMR and MS data.

A gene bank is being established by OAPGRC in collaboration with NMS, UoN and CAMS, SQU comprising more than 2000 strains



More than 200 medicinal plants, marine species and microorganisms have been and are being evaluated for the medicinal value in a well-defined drug-discovery approach

More than 500 published papers in various disciplines were published in high impact journals as well as one patent, 10 book chapters and two books were published



Skillful full-time researchers have been recruited among which are 15 Omani

Full-fledged, state-of-the-art laboratories have been constructed and furnished. Massive capital equipment of more than 5 million Omani riyals have been acquired



More than 200 graduates from different higher education institutions in Oman and abroad spent a training period of two months and above in our laboratories

Several workshops and colloquia were conducted by our staff in different organizations in the Sultanate. In addition, we launched for the first time "Future Scientists Program" to talented high school students.

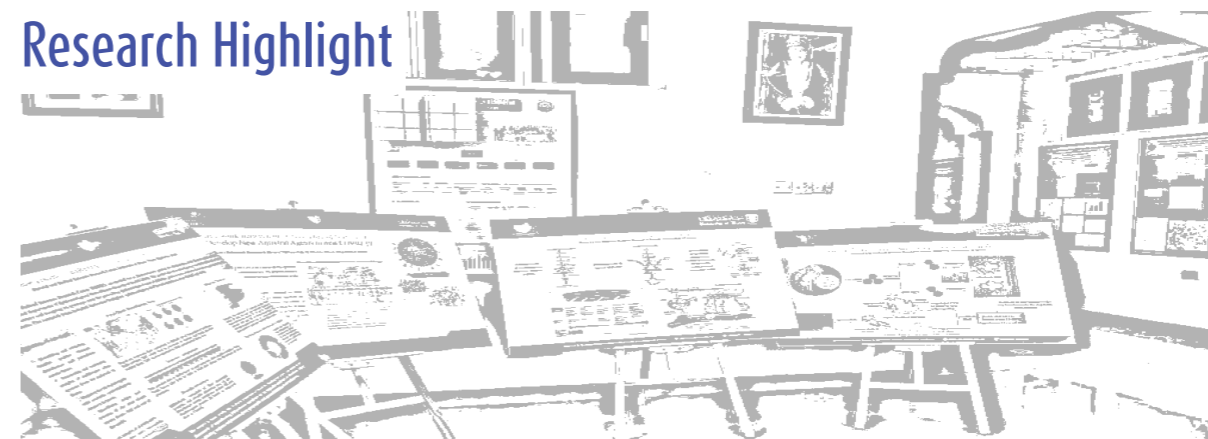


A network of active collaboration is established with international prominent universities and research institutions

Weekly scientific seminars are offered by the staff in the center in our "Science Café"



Research Highlight



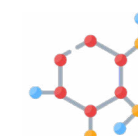
Patented method for the gram-scale isolation, quantification and purification of AKBA.

Evidence for the Involvement of GABAergic Mechanism in the Effectiveness of Natural and Synthetically- Modified Incense Derivatives in Neuropharmacological Disorders.



Development of a new and robust IR & NMR spectroscopic methods coupled with chemometrics supported by molecular analysis that can differentiate gender in immature date palm trees

Chemical, molecular and structural evidences supported the biosynthesis of boswellic acids.



First Chloroplast genomics of Phoenix dactylifera (var. Naghal and Khanezi) are established

The chloroplast genome of Boswellia sacra is established and the work is on progress for WGS



Mesenchymal stem cells (MSCs) were used to treat tendon, bone and cartilage in equine. After mesenchymal stem cell isolation from bone marrow, large quantity of stem cells were expanded and injected to the defected area. The results support current encouraging outcome from clinical use in horses treated with bone-marrow-derived stem cells. Recent studies have also demonstrated that some soluble factors as small vesicles released from stem cells, named microvesicles are responsible for better tissue regeneration. These extracellular vehicles play major role in cell-to-cell communication. Both stem cells and microvesicles were applied to achieve bone regeneration in vivo.



Two pyrolysate products from Omani frankincense smoke: First evidence of thermal aromatization of boswellic acids.



Detection and estimation of Super premium 95 gasoline adulteration with Premium 91 gasoline using new NIR spectroscopy combined with multivariate methods.



Ethical Permission



- Plant collection permits from Ministry of Environment and Climate Affairs.
- Animal collection permits from Ministry of Environment and Climate Affairs.
- All preclinical experiments are in accordance with ethical legislations from the University of Nizwa Ethical Committee for animal research and according to the National Committee for Bioethics.



Intellectual Property

Consequent of the applied character of our current research and development work, commercially sensitive ideas and results are being generated. These require rigorous patent protection, while they are submitted to patents. Inventorship will lie with the creators of the ideas and results, while it is proposed that the ownership will be assigned to the University of Nizwa. In order to facilitate patenting, it is imperative that sufficient funds are available under the Center to afford the filing procedure as well as early-stage maintenance. Costs involved in patent protection can be very considerable indeed; economies in patent protection often negate the protection itself.

Funding

There is a remarkable and steady research progress during the last seven years. UoN has allocated a percentage of its revenues for research in different forms including: research funds, students research support, exchange students support, postgraduate students support, full-time researchers, establishment of research laboratories and acquisition of research equipment. The Center has succeeded so far in attracting over 2,000,000 OMR through internal as well as external research grants. Externally funding sources include, but are not limited to, Oman Research Council, Industrial Innovation Center, GCC co-funding program and SQU-UoN co-funding program. In order to sustain the productivity of the Center, a minimum of 300,000 OMR should be secured through open grants per annum.

Human Resource

The current projects under the Center have executed adequately a very broad range of activities in terms of supervising, reporting and liaising with academic and industrial partners. The University of Nizwa has invested in this by recruiting highly qualified researchers.



First International Conference on Frankincense and Medicinal plants - 2018



The Fourth Middle East International Dermatology & Aesthetic Medicine Conference - 2019

“

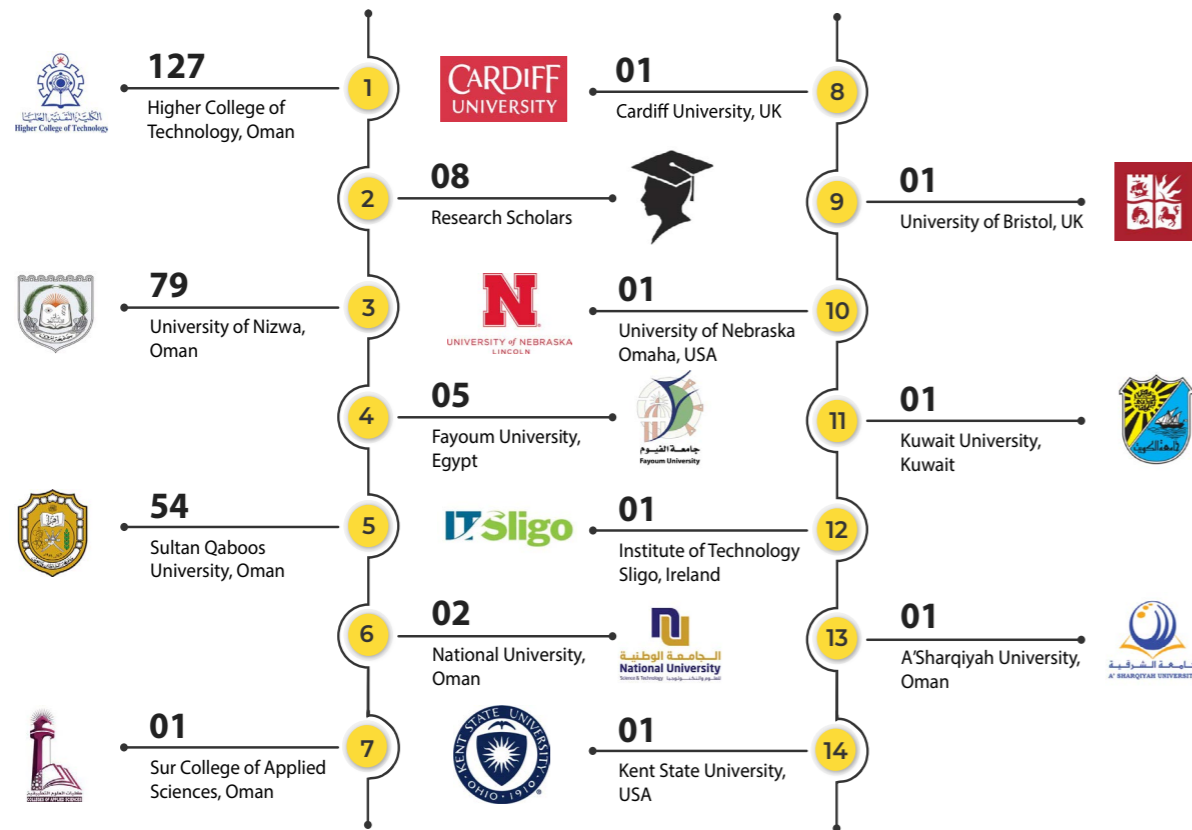
NMSRC is a consortium of distinguished scholars & researchers with multidisciplinary scientific backgrounds.

”



Training

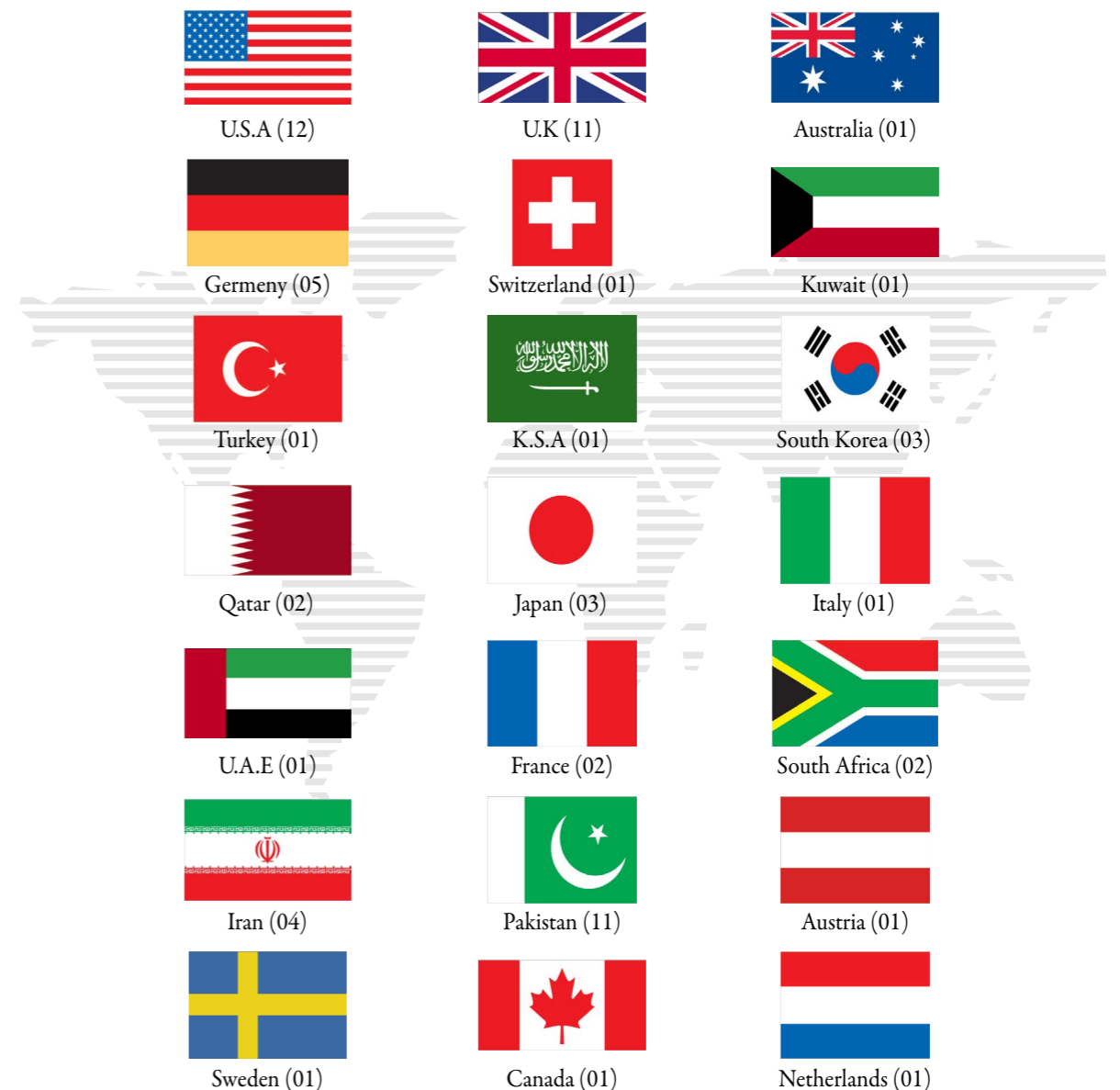
The center serves as a hub for students to conduct their training by involving in ongoing research projects at the laboratories of the center.



Collaborations: National



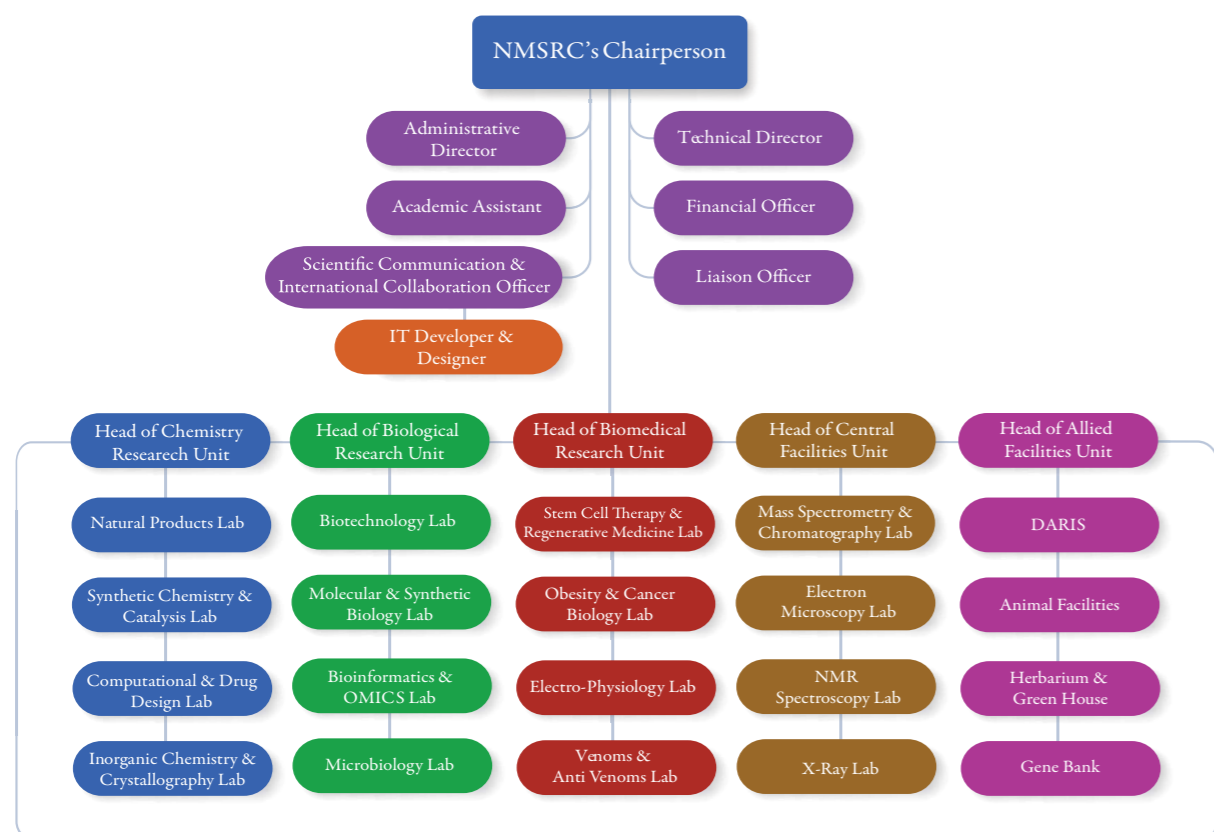
Collaborations: International (With number of Institutions)



International Internship for Oxford University Students at NMSRC - 2019

NMSRC Structure

In order for the Center to have sufficient time and resources to fulfill its duties, it is mandatory to establish a robust and broad structure. The University of Nizwa has employed a director technical who will be responsible for purchases of equipment and consumables. He will be a focal point between the Center, the finance department and the companies. The University will also appoint an academic assistant to the Center with the main task of delivering the teaching curriculum to be developed and liaised with various stakeholders.



NMSRC Research Team - 2019

Research Alignment

The Natural and Medical Sciences Research Center (NMSRC) aligns its research projects with the 3 major development guidelines used by the Omani government:



The United Nations' 17 Sustainable Development Goals - 2030









The 12 Strategic Directions of the Oman Vision 2040









Developing the necessary skills for the 4th Industrial Revolution

Education and Community Outreach

NMSRC Education & community outreach	Oman Vision 2040	UN's Sustainable Development Goals 2030
<ul style="list-style-type: none"> Graduate students training at the center. School Outreach. Community Outreach. Seminars on the environment, reptiles, water conservation, renewable energies, etc. Partnership with internal i.e. UoN and external i.e. ESO, MOE. Caves, Wadis, and others local environment exploration. Fauna and flora data collection. Partnerships with Ministry of Environment, Ministry of Tourism, Ministry of Agriculture and Fisheries, OBG, OAPGRC, SQU. International Research Cooperation, international students' internships, Omani students' research abroad, Scientific workshops, Conferences, Open lectures. 	<ul style="list-style-type: none"> Inclusive education, sustainable learning, and scientific research that leads to a knowledgeable society and competitive national capabilities. A society proud of its identity and culture and committed to its citizenship. Effective, balanced, and flexible ecosystems in order to protect the environment and ensure the sustainability of its resources in support of the national economy. 	<div style="display: flex; flex-wrap: wrap; justify-content: space-around;"> <div style="text-align: center; margin: 5px;">  <p>4 QUALITY EDUCATION</p> </div> <div style="text-align: center; margin: 5px;">  <p>9 INDUSTRY INNOVATION AND INFRASTRUCTURE</p> </div> <div style="text-align: center; margin: 5px;">  <p>12 RESPONSIBLE CONSUMPTION AND PRODUCTION</p> </div> <div style="text-align: center; margin: 5px;">  <p>13 CLIMATE ACTION</p> </div> <div style="text-align: center; margin: 5px;">  <p>14 LIFE BELOW WATER</p> </div> <div style="text-align: center; margin: 5px;">  <p>15 LIFE ON LAND</p> </div> </div>

Industry Consulting

NMSRC Industry Consulting	4th Industrial Revolution	Oman Vision 2040	UN's Sustainable Development Goals 2030
<ul style="list-style-type: none"> Sustainability Environmental Protection and Remediation Oil & Gas, Hospitality Industries Industry Research and Applications Natural product based on knowledge National economy diversification Oil & Gas Industries, Agriculture, Pharmacology, Perfumery, cosmetics SME entrepreneur support 	<ul style="list-style-type: none"> Innovation 	<ul style="list-style-type: none"> Inclusive education, sustainable learning, and scientific research that leads to a knowledgeable society and competitive national capabilities. A society proud of its identity and culture and committed to its citizenship. Effective, balanced, and flexible ecosystems in order to protect the environment and ensure the sustainability of its resources in support of the national economy. 	     

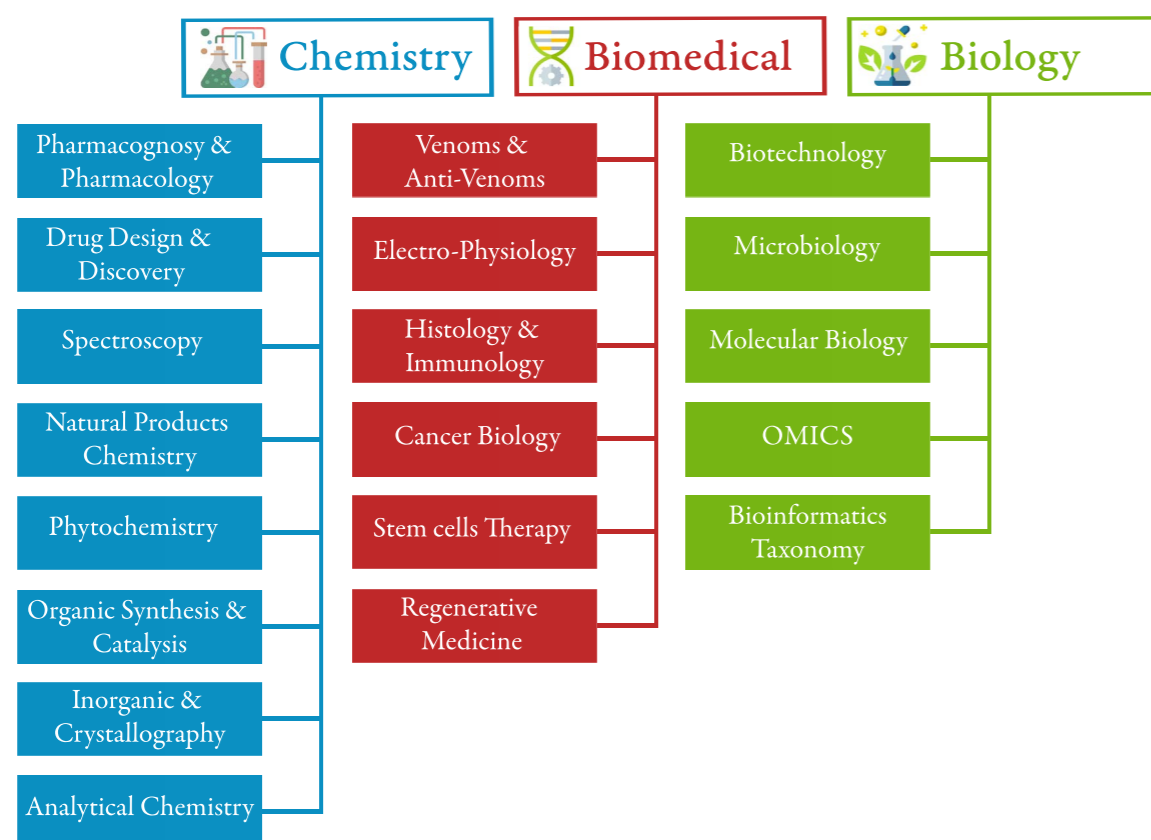
Research Topics

NMSRC Research Topic	4th Industrial Revolution	Oman Vision 2040	UN's Sustainable Development Goals 2030
<ul style="list-style-type: none"> Plant genomes, Natural products of Oman medicinal plants, Chemical & biological properties of Natural pure compounds, Essential Oil Research and olfactometry. Microbes diversity, Biotransformation, Biotechnological applications. Natural Products and bioactive compounds from Marine species, Marine-Microbes isolation and identification. Stem cells and regenerative Medicine, Bone healing, Wound Healing, Venom Research, Diabetic and Cancer Research, In-vitro & In-vivo experiments. Next Generation Sequencing (NGS), 3D Computational Biology, Bio-informatics. 	<ul style="list-style-type: none"> Innovation Nanotechnology Synthetic Biology 3D Bio Printing 	<ul style="list-style-type: none"> Inclusive education, sustainable learning, and scientific research that leads to a knowledgeable society and competitive national capabilities. A pioneering health-care system with international standards. A society proud of its identity and culture and committed to its citizenship. A diversified and sustainable economy that embraces knowledge and innovation, operates within integrated frameworks, attains an accomplished competitiveness, keeps abreast of industrial revolutions, and achieves fiscal sustainability. Effective, balanced, and flexible ecosystems in order to protect the environment and ensure the sustainability of its resources in support of the national economy. 	        



Research Relevance

The research being conducted under this Center should help explaining the interactions between plants and humans and is leading to advancements in the prevention and treatment of common diseases in Oman and the region including cancer, cardiovascular diseases and diabetes. Our very promising results in this field have been disseminated to international community through publications and to the local community via media. The research areas associated with the Center demonstrate the multidisciplinary nature of research thereby providing an excellent research environment for training of Omani graduates in the field of chemistry, biology, pharmacy and medicine. The following figure illustrates this interaction.



Capacity Building

Workshops and colloquia are being held for the training of manpower and to create awareness about the potentials of medicinal plants and marine natural products application. At least 5 such moots will be held each year in different areas so that the relevant information is disseminated widely.

National and international forums will be organized to discuss scientific and technological developments leading to new ideas. Sharing of knowledge and project results will help in planning economic development of medicinal plants and marine natural products. The potential cooperative organizations would be Diwan of Royal Court, Oman Botanic Garden, Ministry of Tourism, Public Authority for Craft Industries, Ministry of Health, Ministry of Agriculture and Fisheries as well as Academic institutions. Regular meetings or conferences are held to review critical evaluation of the Center results and plan for future. The Center is establishing a herbarium for medicinal plants in addition to a museum for the genetic of natural resources.



Themes & Scopes

The main theme of research activities under the Center involves the study of biologically active natural compounds from medicinal plants and marine natural products, which ranges from collection to purification and structural elucidation of the compounds. Biological activities, utilization, synthesis, and structure-activity relationships of isolated compounds are being carried out in collaborations with scientists in related fields such as microbiology, pharmacology, agricultural chemistry, and medicine. The 2020 onward focus will be towards drugs discoveries.

Center's Duties

The Center's duties include the following:

- Develop a body of research in the fields of chemistry, pharmacognosy and pharmacology of medicinal plants and marine natural products of Oman
- Attract funds through research proposals locally, regionally and internationally
- Build network with other researchers and research bodies in Oman and abroad, including industry and non-governmental organizations
- Contribute to public understanding and policy development in the areas of chemistry, biology, pharmacognosy and pharmacology of medicinal plants and marine natural products
- Contribute to the training of highly qualified personnel
- Enhance financial resources through innovations and products directed to the market

The Center is led by a professor to undertake work at an ultra-precompetitive level and has the freedom to develop an area of natural products which will ultimately grow so that industry could take forward. The Center is subjected to an annual review of achievement with a major review every three years. From the outset, the Chair-holder has made industrial connections, thereby stimulating interest and dialogue of mutual benefits.



First ICFMP delegation visit at NMSRC - 2018



Ongoing Strategic Projects (International)



With the University of Oxford

- Chemistry of inflammation
- Beta-lactam biosynthesis
- Natural products chemistry
- Development of new antiviral agents to treat Covid-19



With the Liverpool School of Tropical Medicine

- Snakes genomics
- Venome and anti-venom research



UNIVERSITY of NEBRASKA
LINCOLN

With the University of Nebraska

- Genomics and metabolomics of Boswellia genus
- Metagenome of desert plants
- Whole genome sequencing of dragon trees



With the Nice Sophia Antipolis University

- Essential Oil Research



With the Martin Luther University Halle-Wittenberg

- Natural and synthetic products



With the Kew Royal Botanic Gardens & Royal Botanic Garden Edinburgh

- Plant taxonomy



Ongoing Strategic Projects (National)



With the Ministry of Agriculture and Fisheries

- Transcriptomic of Dubas Bug
- Genomics of Date Palm Trees
- Genomics & Metabolomics of Mango Trees
- Genomics & Metabolomics of Bananas



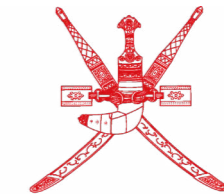
With the Diwan of Royal Court

- Office for Conservation of Environment
- Oman Botanic Garden



With the Ministry of Health

- Molecular Epidemiology and Sequencing of SARS-CoV-2 Virus
- Epidemiology of SARS-CoV-2 infection among health workers
- Bacterial Antibiotic Resistance



Ministry of Higher Education, Research & Innovation

With the Ministry of Higher Education, Research and Innovation

- Gene Bank of Oman
- High Throughput Screening of Oman
- Genetic Natural Resources

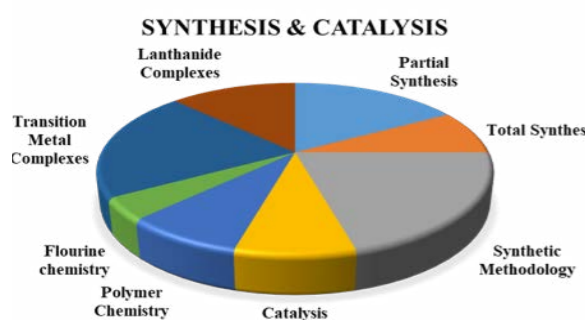


Research and analysis at the NMSRC

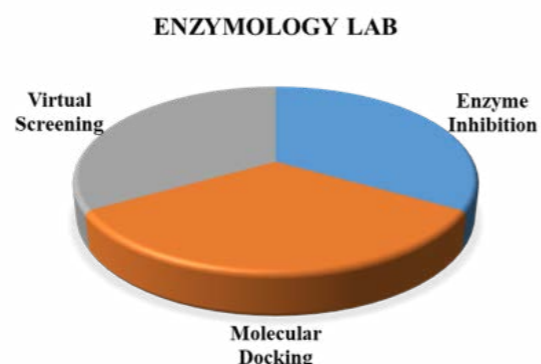


Ongoing Research Projects

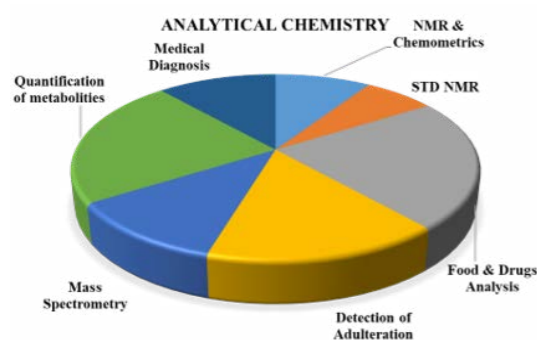
Total numbers of projects : 24



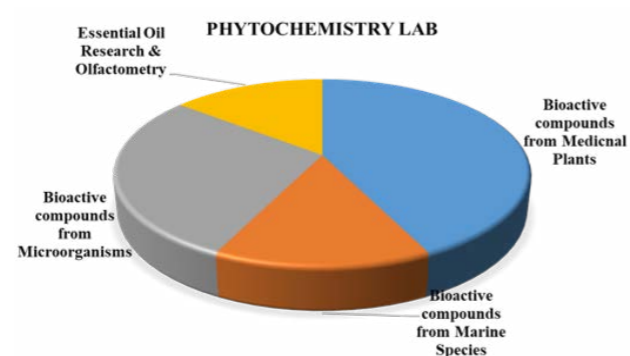
Total numbers of projects : 30



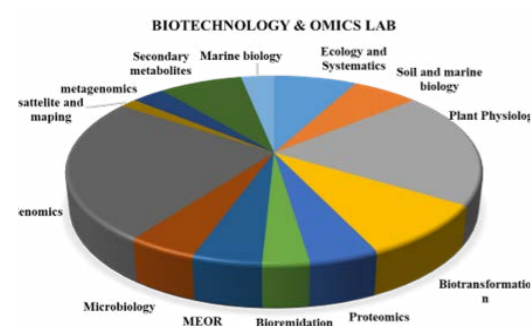
Total numbers of projects : 44



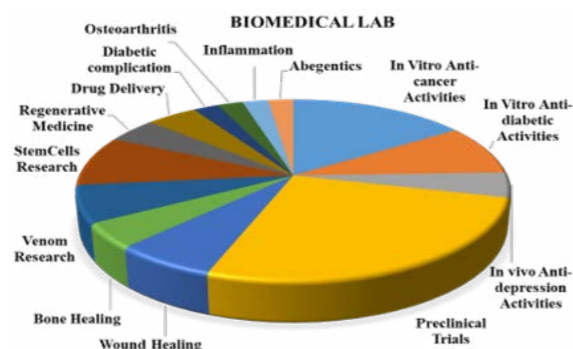
Total numbers of projects : 35



Total numbers of projects : 65

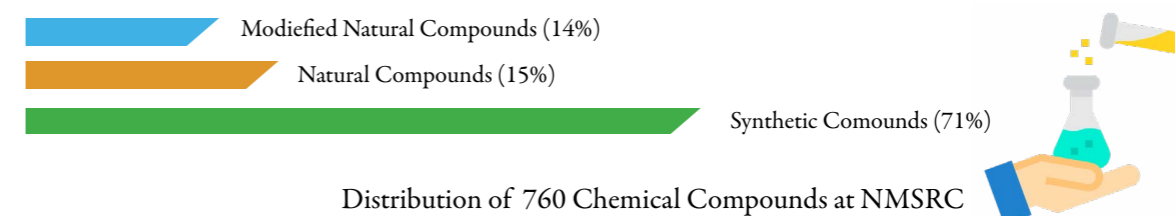


Total numbers of projects : 45



Chemical Compounds Library

The NMSRC proud to have in-house database of chemical compounds which are collected by different research laboratories of the Center constituting a total of 760 chemical entities of natural, semi-natural and synthetic origin. This library is accessible for the research in new biological area, for hit-to-lead design and design and discovery of new drugs. The collection contains no commercially available/or compounds from any commercial/industrial chemical libraries. The natural compounds were extracted from various natural resources i.e. plants and microorganisms collected from different regions of our homeland, Oman. The synthetic compounds were prepared within institute in different research groups for purposes varying from total synthesis of natural products, their application in medicinal chemistry and improving the synthetic methodology. The details and chemical properties such as 2D and 3D structures of compounds are deposited in our database which is readily available for different studies.



Distribution of 760 Chemical Compounds at NMSRC

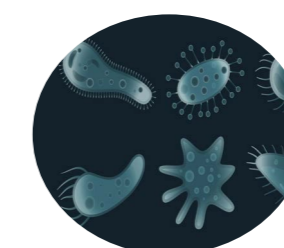


Oman Gene Bank

NMSR Center proud to be the host of the first ever gene bank in Oman, which has been established in collaboration Oman Animal & Plants Genetics Resources Center (OAPGRC). The aim of this impitious project is to identify, maintain, preserve and propagate the available living genetic resources of Oman. In initial phase, the lab is hosting microbial genetic resources and seed bank for the cultivated and wild plants of Oman. Future focus is also on working on animal, marine and insect resource of the country. This also aims to conserve the unique gene pool for conservation purposes.



Fungal species
1809



Bacterial species
142



Plant accessions
130



Impact to Oman

Scientific Impact

The work under this Center is producing a comprehensive set of data by focusing on Medicinal Plants and Marine Natural Products and related natural resources of Oman. The project is motivating and stimulating research cooperation between biologists, taxonomists, natural products chemists, synthetic chemists, analytical chemists, pharmacologists, microbiologists and molecular biologists. International collaboration has been initiated with several prominent research institutions. Likewise, local collaboration with concerned government and private industries and institutions has been set.

Despite considerable research and development efforts for the discovery of synthetic drugs, there is paucity for the discovery of natural drugs and therefore there is a massive scope for finding alternative natural and safe drugs from natural products. In this regard, this Center brings cutting-edge research to the Sultanate of Oman.

Academic Impact

This Center constitutes an excellent research hub leading to awards of 6 Ph.Ds. via co-supervision, more than 40 B.Sc. degrees and hosted more than 300 graduate students for their internship and training. Chemistry, Biology and pharmacy graduates are enjoying the opportunity of getting state-of-the art training in the Center through courses, senior research projects, postgraduate projects, workshops and seminars. The graduates are carrying this knowledge to the Omani industries, which in turn benefits the economy.

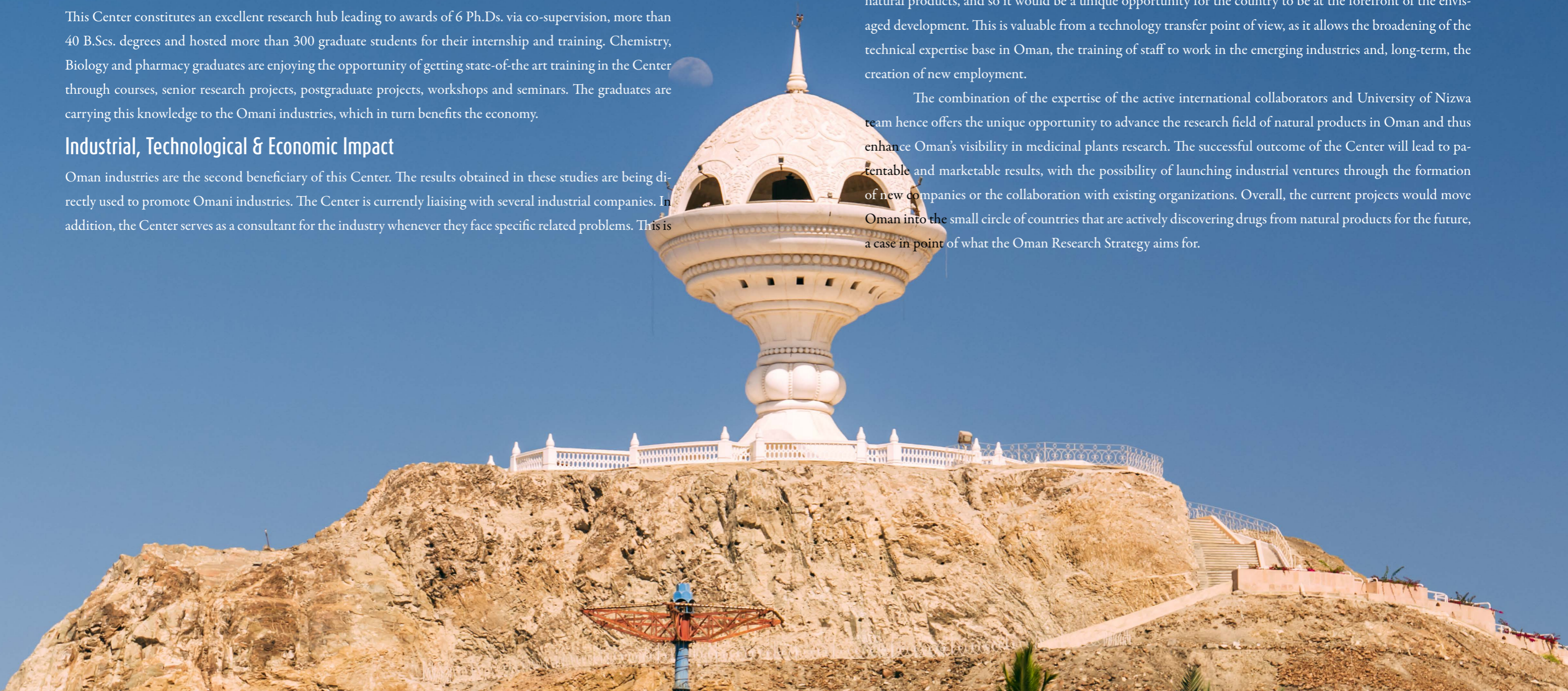
Industrial, Technological & Economic Impact

Oman industries are the second beneficiary of this Center. The results obtained in these studies are being directly used to promote Omani industries. The Center is currently liaising with several industrial companies. In addition, the Center serves as a consultant for the industry whenever they face specific related problems. This is

in agreement with the Sultanate of Oman's goals of attracting and establishing new industries, with the aim of diversifying its economic foundations, increasing its knowledge pool and creating new employment. A particular attraction lies in industries that are linked to the country's wealth of medicinal plants and marine life and have the potential to provide significant added value to the economy. The present Center fulfils these requirements. The raw materials employed are plants and marine organisms, and the isolation of lead compounds from them will lead to products of considerable economic value. Moreover, the main application of the intended products is in the drug-discovery market, which is an area of rapid growth when it comes to the chiral pool and will initiate the creation of a skilled and specialised workforce.

Overall, the successful outcome of the project will enhance the Sultanate's visibility in a modern and growing research field and may, in the longer term, contribute towards the establishment and growth of new and attractive pharmaceutical industries within the country. In addition, the Sultanate of Oman is in possession of enormous medicinal plants and marine organisms resources, and it is highly desirable that these resources be processed within the country so that value adding occurs in the country. Overall, the Sultanate of Oman's rich wealth of natural products makes it an ideal location for establishing new pharmaceutical industries based on natural products, and so it would be a unique opportunity for the country to be at the forefront of the envisaged development. This is valuable from a technology transfer point of view, as it allows the broadening of the technical expertise base in Oman, the training of staff to work in the emerging industries and, long-term, the creation of new employment.

The combination of the expertise of the active international collaborators and University of Nizwa team hence offers the unique opportunity to advance the research field of natural products in Oman and thus enhance Oman's visibility in medicinal plants research. The successful outcome of the Center will lead to patentable and marketable results, with the possibility of launching industrial ventures through the formation of new companies or the collaboration with existing organizations. Overall, the current projects would move Oman into the small circle of countries that are actively discovering drugs from natural products for the future, a case in point of what the Oman Research Strategy aims for.



Publications

The Center has published more than 800 research articles in journals of international repute and impact factor. These journals include PlosONE, RSC advances, Chemical Reviews, Tetrahedron, European journal of Medicinal Chemistry, Measurements, Food Chemistry, Plant physiology, Frontiers in Plant Sciences and Frontiers in Microbiology, Environmental Experimental Botany, Journal of Hazardous Material, Critical reviews in Biotechnology, Dalton Trans, Synletters, angewandte chemie, etc. The total impact factor of these publication ranges to 1,515, whereas the average impact factor is 1.98. The total citation of these articles is 14,495, which is increasing every year.



Equipments & Facilities

Biotechnology and OMICS laboratories

Next-Generation Sequencing set-up
 Bioanalyser 2100
 DNA 120 OP
 QuantStudio™ 5 Real-Time PCR System
 PCR System (Applied Biosystems USA)
 Qubit™ 3.0 Fluorometer
 Object Scan 1600*
 Fermentor
 The ZOOM™ IEF Fractionator kits
 Class II, Type A2 Biological Safety Cabinets
 xMark Microplate Absorbance Spectrophotometer
 Denaturing gradient gel & Electrophoresis systems
 Autoclave (SX 700E; Tomy; USA)
 Refrigerated centrifuge (ProScientific)
 Digital Heating Shaking Drybath
 Thermo Scientific Heraeus Pico 17 microcentrifuge
 Tissue homogenizer
 Gel-Drier (LabTech)
 Gel Documentation System
 Fisher Scientific™ Bead Mill 24 Homogenizer
 The Thermo Scientific™ Pierce™ Power Blotter
 The Mini Gel Tank
 Bioinformatics Server, Lenovo P910 Workstation
 Dell Precision 7910 Tower Workstation
 Cold storages (SANYO; LG)
 Freeze-Drier (LabTech)
 Ultra sonicator Elmasonic P
 Vertex
 Ice maker (LabTech)
 Tabletop centrifuge
 Incubators
 Incubators and open Shakers (Korea)
 Dry Bath (Clever Sci)
 HANA pH and electrical conductivity meters

Biomedical sciences laboratories

Transmission Electron Microscope (TEM)
 Scanning Electron Microscope (SEM)
 IVIS Lumina XRMS In Vivo Imaging System
 Individually Ventilated Cages (IVC)
 Guava® easyCyte Flow Cytometry
 CO₂ incubators

Class II, Type A2 Biological Safety Cabinets
 Inverted and fluorescence microscope with camera
 Reptile cages and Bird cages
 Centrifuges with different tubes volumes
 PH meter
 Liquid nitrogen supply and storage tanks
 Venoms freeze dryer

Natural products and Chemistry laboratories

Bruker Nuclear Magnetic Resonance (NMR) Spectroscopy
 Bruker X-ray Diffraction (XRD)*
 Agilent Technologies 6530 Accurate
 Mass Q-TOF LC/MS*
 Bruker Single Crystal X-ray diffraction*
 PerkinElmer OPTIMA 8000 Inductively Coupled Plasma Optical Emission Spectrometry ICP-OES*
 Bruker SENTERRA II Compact Raman Microscope*
 Bruker Fourier Transformer Infra-Red spectroscopy (FTIR; TENSOR 37)*
 Perkin Elmer Near Infra-Red (NIR)
 Agilent Analytical HPLC (Agilent)
 JAI Preparative HPLC (Gradient Solvent System)
 High Performance Liquid Chromatography- Ultra Violet detection (HPLC-UV)
 Liquid Chromatography- Mass Spectrometry (LC-MS)
 Gas Chromatography – Flame Ionization Detector (GC-FID)
 Gas Chromatography – Mass Spectrometry (GC – MS)
 Atomic Absorption Spectroscopy (AAS)
 Inductively Coupled Plasma - Mass Spectrometry (ICPMS)
 Cary 100 UV-Vis with S/W
 PerkinElmer LS-55 Fluorescence Spectrometer (220 VAC)
 Polarimeter
 Milestone New Microwave Essential Oil System (NEOS)
 Kjeldahl Apparatus (KjelFlex K-360)
 Moisture Analyzer
 Melting Point Apparatus
 Microwave Synthesis Reactor (MSR)
 Buchi Rotary Evaporator
 Karl Fischer Coulometric Titrator
 Buchi Medium Pressure Liquid Chromatography (MPLC)
 Differential Scanning Calorimeter (DSC)
 Particle size analyzer
 Texture analyzer



Seminars

Seminars are organized on a monthly basis in the NMSRC conference room and feature both in house researchers and invited speakers. The main aim of these seminars is to showcase current research done in the labs and to get input and feedback from colleagues and guests in other specialties, insuring a collegial, interactive and innovative research atmosphere within the Center.

Conferences and Symposia

The NMSRC researchers are participating in many national, regional and international events, allowing them to share their research with fellow scientists and to find new possibilities for collaborations. The NMSRC also organizes international symposium, most notably the first International Conference on Frankincense and Medicinal Plants, which took place in 2018 in Oman with many international and national participants.

Workshops

Workshops are organized both in the NMSRC Center and outside in the community. They cover a large variety of topics, from current research to hands on demonstration on environmental conservation, industry specific topics and educational outreach. Reaching out to young students and to the Omani public at large is very important to the NMSRC, and our researchers enjoy meeting with the public and sharing their passion for science and the environment.



Training workshop on Genomics and Bioinformatics Techniques, organizing by NMSRC, February 2019

Agreements (MoU)

- Sultan Qaboos University
- Qatar University
- Oman Botanic Garden
- Ministry of Agriculture, Fisheries & Water Resources
- Diwan of Royal Courts
- Indriyam Biologics Private Limited, India
- INALCO Institute Paris, France
- University of Malaya, Malaysia
- Explicyte, Paris, France
- Analyticon Discovery GmbH
- Alama Tabtabai University Tehran, Iran
- University of Oxford
- Directorate General of Disease, Surveillance and Control, Ministry of Health



NMSRC Faculties, Staffs, Students & Alumni



Administration & Technical

Prof. Ahmed Al-Harrasi, Chairman	Dr. Obaid Khan, Director Technical Operations
Mr. Aflah Al-Hadrami, Administrative Director	Mr. Saud Al-Busaidi, Coordinator
Mr. Ahmed Nasser Salim Al Rawahi, Scientific Communication & Collaboration Officer	
Mr. Syed Mohammad Sarfaraz Hamid, IT Developer/Designer	Dr. Djamila Gabruck, Liaison Officer

Natural Products Lab

Dr. Najeeb Ur Rehman, Research Assistant Professor	Dr. Tania Shamim Rizvi, Research Assistant Professor
Mr. Mohammed Said Saleh Al Azri, Research Assistant	Mr. Kashif Rafiq, PhD Exchange Program Researcher
Dr. Saurabh Bhatia, Associate Professor	

Medicinal Chemistry & Computational Drug Design Lab

Dr. Ajmal Khan, Research Assistant Professor	Dr. Sobia Ahsan Halim, Research Assistant Professor
Mr. Mohammed Khait, Research Assistant	Mr. Majid Khan, PhD Exchange Program Researcher
Mr. Touqeer Ahmad, Research Assistant	

X-ray Crystallography Lab

Dr. Usman Anwar, X-ray Facility Manager	Mr. Rashid Al-Harrasi, Research Technician
Mr. Mohammed Sulaiyam Al Jassasi, Research Assistant	

Microbiology Lab

Dr. Abdullah Al Hatmi, Assistant Professor	Mr. Saif Al Hosni, Research Assistant
Mrs. Khadija Al Hosni, Research Assistant	

Synthetic Chemistry Lab

Dr. Ali Rostami, Assistant Professor	Dr. Satya Kumar, Researcher
Dr. Sulaiman Al-Sulaimi, Assistant Professor	Mr. Sulaiman Al Shidhani, Researcher Assistant
Dr. Muhammad Ali, Assistant Professor	Mr. Syed Raze Shah, PhD Exchange Program Researcher
Mr. Amirhossein Ebrahimi, PhD Exchange Program Researcher	

Biomedical Research Lab

Dr. Sulaiman Al Hashmi, Assistant Professor	Dr. Majid Khamis Al Salmani, Assistant Professor
Dr. Fatemeh Jamshidi-adevani, Post-Doc Fellow	Dr. Shaikh Mizanoor Rahman, Associate Professor
Mr. Saeid Vakilian, Researcher	Mrs. Juhaina Hamed ALKindi, Research Assistant
Mrs. Shokoofeh Ghaemi, PhD Exchange Program Researcher	Mr. Mohammed Rashid Al Ofi, Research Assistant

Biotechnology & OMICs Lab

Dr. Abdul Latif Khan, Research Assistant Professor	Dr. Sajjad Asaf, Research Assistant Professor
Dr. Tapan Kumar Mohanta, Research Assistant Professor	Dr. Ali Al Lawati, Assistant Professor
Mr. Ahmed Nasser Salim Al Rawahi, Research Assistant	Mr. Adil Khan, PhD Exchange Program Researcher
Dr. Saqib Bilal, Research Assistant Professor	Mr. Muhammad Numan, PhD Exchange Program Researcher
Mrs. Safiya Salim Mohammed Alamri, Lab Technician	

Herbarium and Greenhouse Lab

Mr. Hilal Saud Al-Naabi, Technician	Mr. Mohammed Al-Broumi, Research Assistant
-------------------------------------	--

Electron Microscopy Unit

Mr. Khamis AL-Riyami, Senior application specialist	Mrs. Sausan Suliem Mubarak Al Yaqoobi, Laboratory Technician
---	--

NMR Unit

Mr. Ananda Narayanan, Facility Manager-NMR Lab	Mr. Ahmed AL-Ghafri, Research Assistant
Mr. Saif Ullah, Instrument Engineer	

Chromatography & Mass Spectrometry Unit

Mr. Parthasarathy Elumalai, Mass Spectrometry Specialist	Mr. Mohammed Al Omairi, Researcher Technician
Mr. Ghanim Salim AAl-Thani, Analysis & Appliance Technician	Mrs. Samia Ahmed Al-Riyami, Research Assistant

Animal Facility unit

Mr. Syed Farooq, Animal Facility Specialist	Mr. Ahmed Hamood Al-Busaidi, Animal Facility Specialist
---	---

Production Unit

Dr. Tanveer Alam, Fragrance Specialist
--

**Current Phd Exchange Students**

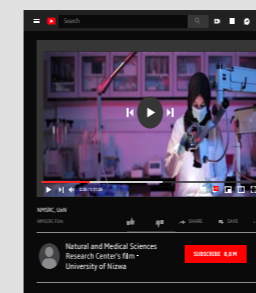
Saeed Ullah (Biochemistry), University of Karachi	Muhammad Waqas (Biochemistry), Hazara University
Wajid Zaman (Molecular Medicine), University of Karachi	Faiz Ullah Khan (Pharmacy), Abdul Wali Khan University
Nasir Ali Khan (Microbiology), Quaid-i-Azam University	Muddaser Shah (Biochemistry), Abdul Wali Khan University
Obaid Ullah (Organic Chemistry), University of Malakand	Taimoor Khan (Biotechnology), Quaid-i-Azam University
Waqar Ahmad (Biotechnology), Quaid-i-Azam University	Rabia Maqsood (Organic Chemistry), University of Okara
Anam Rubab Pasha (Organic Chemistry), Bahauddin Zakria University	Muhammad Azeem (Organic Chemistry), Bahauddin Zakria University

Post-Graduate Exchange Students Alumni

Mrs. Farah Jabeen	Ms. Samina Ali
Mr. Nisar Ahmed	Mr. Hidayat Ullah
Mr. Imtiaz Hussain	Mr. Sajid Ali
Mr. Amjad Khan	Mr. Riaz Ahmed
Mr. Aasim	Mr. Wajid Hussain
Mr. Umair	Mr. Amjad Ali
Mr. Fazal Akber	Ms. Asma Bani Orabah
Mr. Arif Khan	Mr. Maroof Ali Toori

Alumni

Dr. Hidayat Hussain, Senior Scientist	Dr. Thomas Dzeha, Researcher
Dr. Zahid Hassan, Research Assistant Professor	Dr. Liaqat Ali, Research Assistant Professor
Prof. Tee Han, Visiting Professor from Seoul National University College of Medicine, Seoul, Korea	
Mr. Abdulaziz Al Dhuhli, Research Assistant	Mr. Adil Adrees, NMR Spectroscopist
Mr. Zaid Khalifa Al-Hinai, Technician	Dr. Husain Yar Khan, Researcher
Mrs. Noor Mazin Abdulkareem, Research Assistant	Mr. Omar Salim Al-Sudairy, Research Assistant
Mr. Devakannan Gunasekaran, Mass Spectroscopy Expert	

NMSRC Film

<https://bit.ly/3s2WwOD>

Click the link
to watch the film



Scan Me
to watch the film

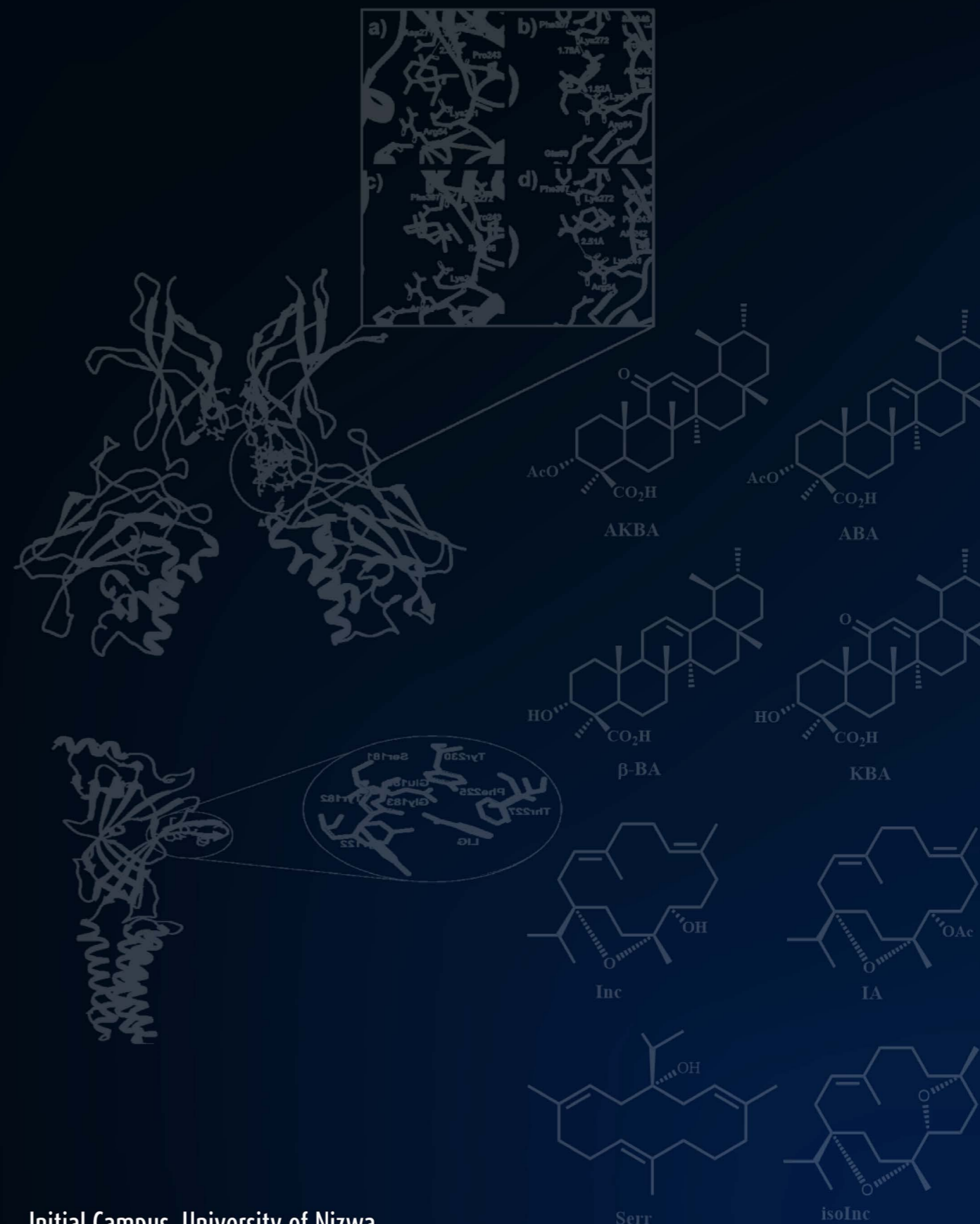


“

The achievements and activities presented in this book wouldn't have been possible without the generous support from the University of Nizwa which is reflected in recruitment of researchers, support of PhD students, building and furnishing the research laboratories and acquiring capital equipment.

”





Prepared and edited by

Prof. Ahmed Al Harrasi

Revision and content updates:

Dr. Abdullatif Khan, Dr. Suliman Al-Hashmi,

Dr. Ali Rostami, Dr. Najeeb Rehman,

Mr. Ahmed Al Rawahi &

Mr. Mohammed Al-Broumi

Language editing:

Dr. Djamila Gabruck

Cover & book design:

Mr. Aflah Al Hadrami,

Mr. Ahmed Al Rawahi &

Mr. Syed Mohammad Sarfaraz Hamid

Copyright © 2021 by Natural and Medical Sciences Research

Center. Printed by the University of Nizwa, Sultanate of Oman



**Initial Campus, University of Nizwa
Birkat Al Mouz, Nizwa, Sultanate of Oman**

Post / Zip Code: P.O. Box 33, PC 616

Telephone: 00968 25446329, 00968 25446470

Fax: 00968 25446612

Email: nmsrc@unizwa.edu.om

URL: <https://www.unizwa.edu.om/index.php?contentid=1038>

Twitter: @NMSRC_UNizwa

Google Scholar: Natural & Medical Sciences Research Center

URL: https://scholar.google.com/citations?user=PT_F7JAAAAAJ&hl=en&authuser=1