

Research Annual Report 2019-2020

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Foreword

Foreword

Professor Ahmed Al-Harrasi

*Vice Chancellor for Graduate Studies,
Research and External Relations*



I am delighted to share this annual report for 2019-2020, which highlights the research achievements at The University of Nizwa.

The University of Nizwa has implemented a research strategy that emphasizes on a dynamic process to support research in different fields including biological and chemical sciences, health sciences, engineering, economy, management, information system, educations and arts.

The University recognizes that research is central to its long-term viability and success. The University will strive to keep improving its research infrastructure to enable its faculty and students to achieve success as scholars. To accomplish these goals the University stresses to enhance the capacity of its students and faculty, focuses on basic and applied research, integrates research into teaching, ensures interdisciplinary in research and diversity of research funding, considers research as an important component for growth and partnership with the society and adhere to the highest ethical standards and moral values.



Abbreviations

CAS-A/S College of Arts and Sciences –Arts/Sciences

CEA College of Engineering and Architecture

CEMIS Collage of Economy management and information system

CPN-P/N College of Pharmacy and Nursing- Pharmacy/Nursing

FURAP Faculty mentors undergraduates research award program

GRG Graduates Research Grants

NCMSM National Chair of Materials Science and Metallurgy

NMSRC Natural and Medical Sciences Research Centre

ORG Open Research Grants

TRC The Research Council

URG Undergraduates Research Grants

Ranking
2019-2020

- 1st In Oman (nature Index)*
- 669th Overall world ranking*
- 426th Research world ranking*
- 413th Innovation world ranking*
- 236th Societal world ranking*



SECTION-1
@GLANCE





At Glance

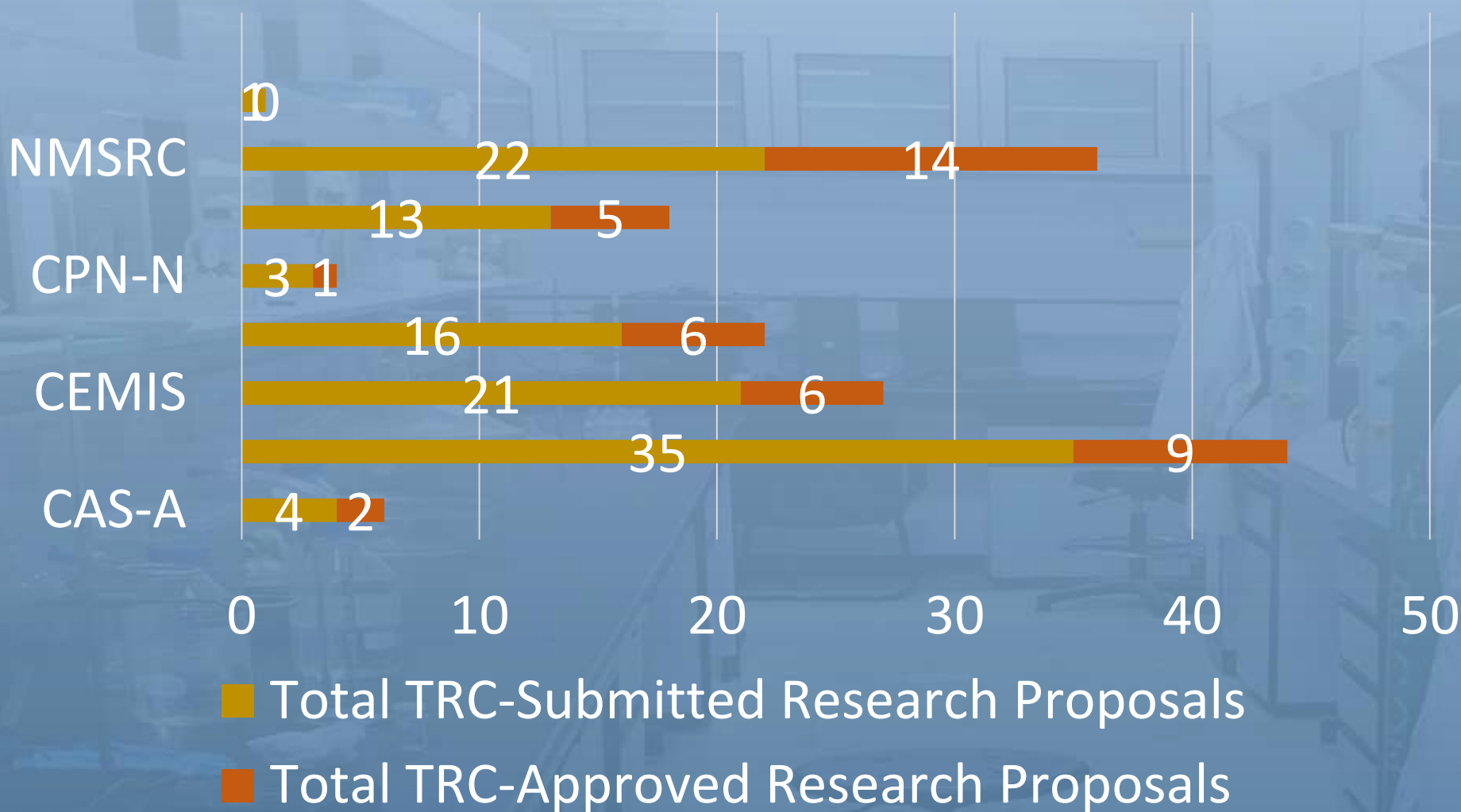




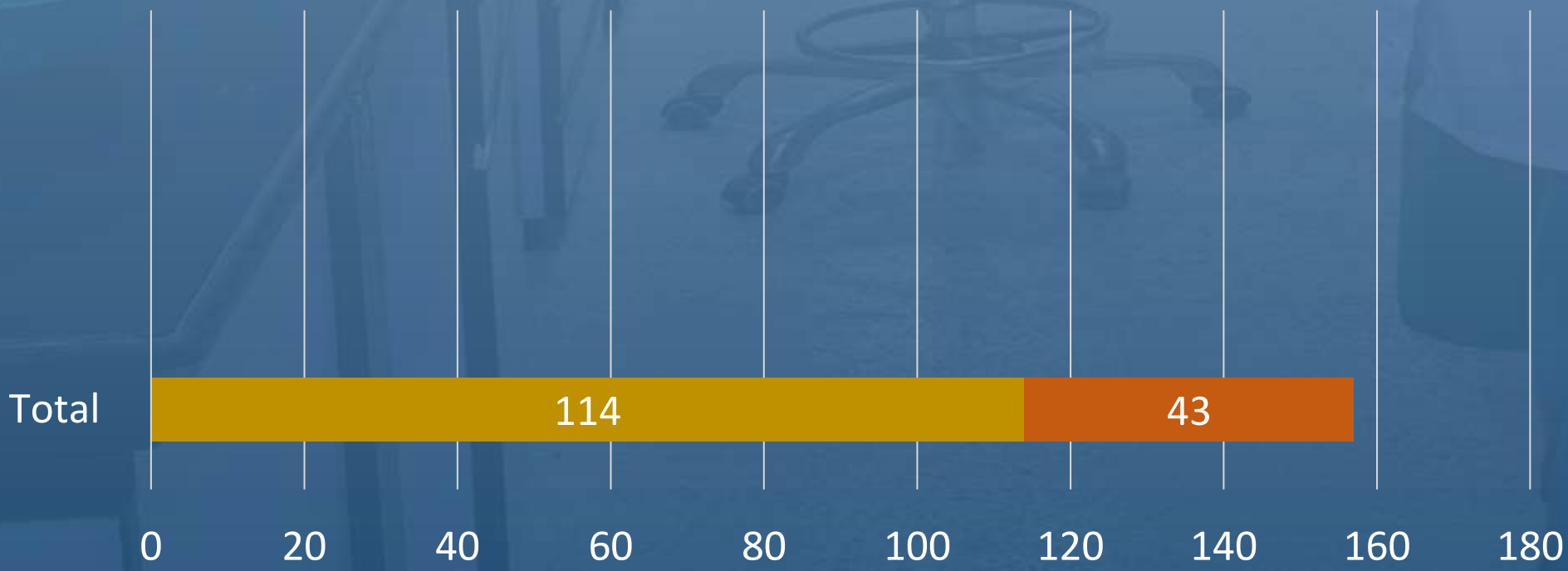
SECTION-2

RESEARCH FUNDING

Total Submitted /Approved Research Proposal under ORG/RG TRC-Programs per College/Center (2009-2019)

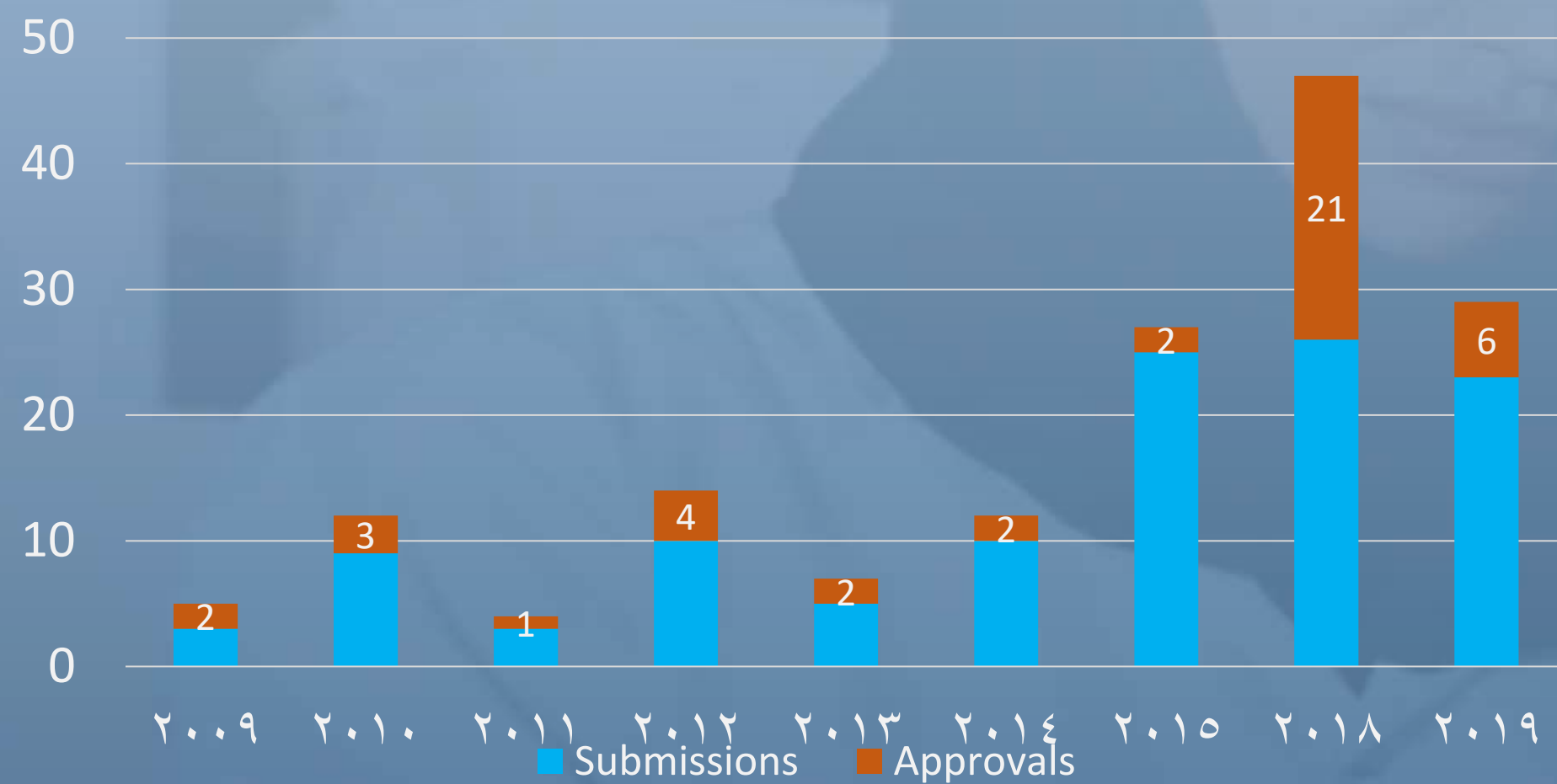


Total Fund Received Under ORG/RG TRC-programs (in OMR) by College/Center (2009-2019)

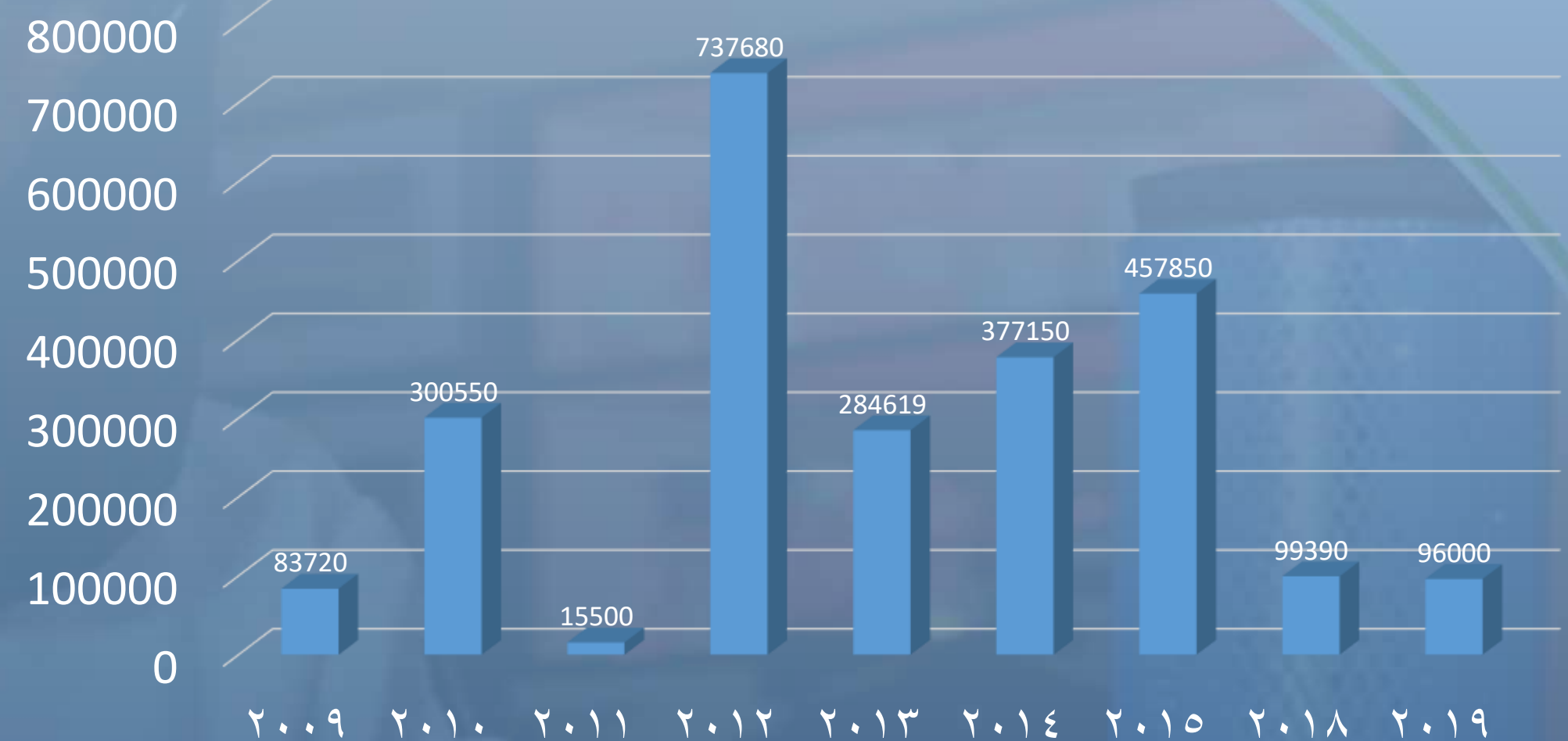


Total ORG/RG Fund 2.4923 Million

Total TRC- submitted /approved research proposal/year

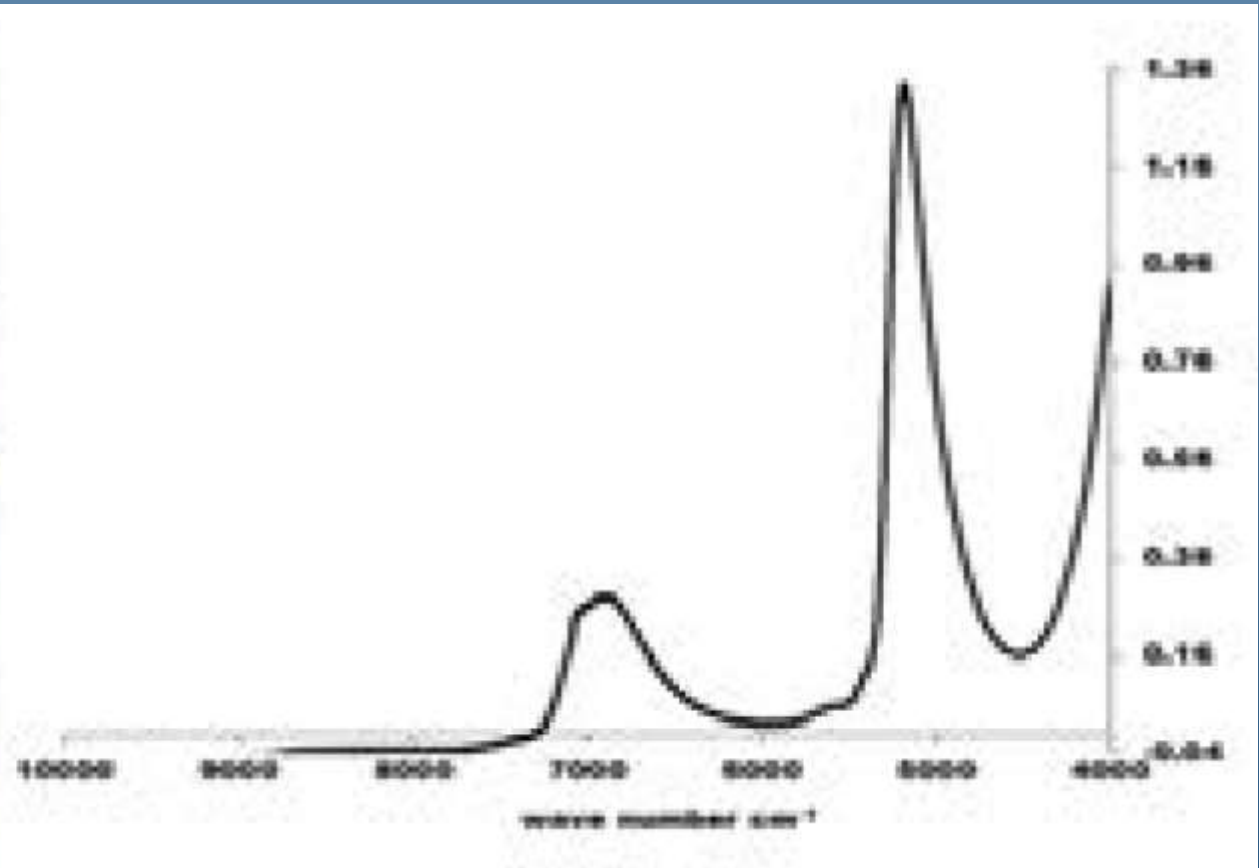
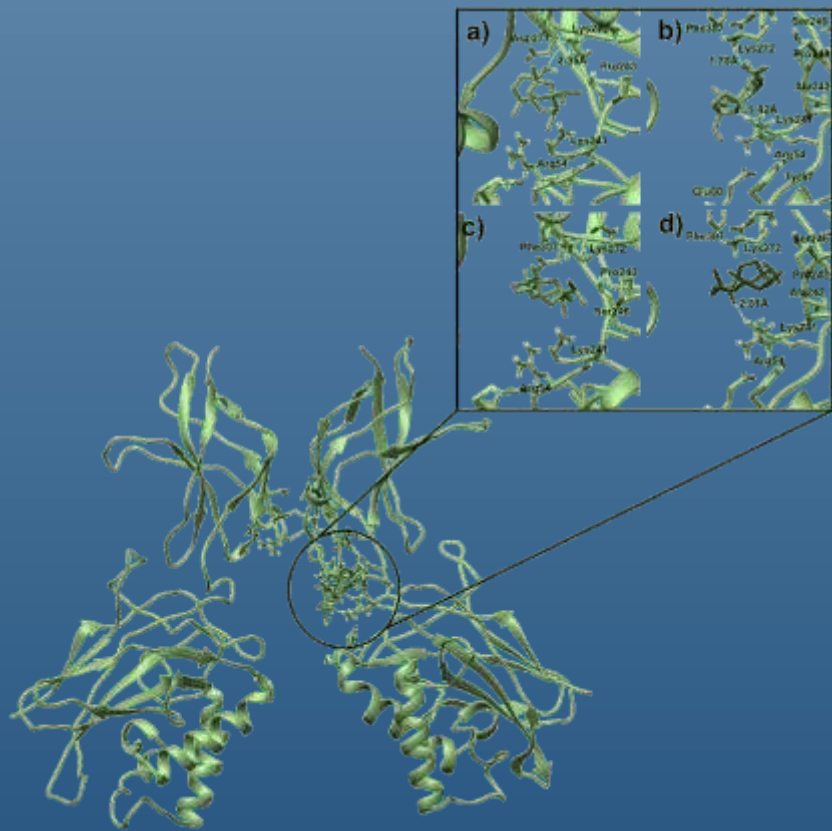
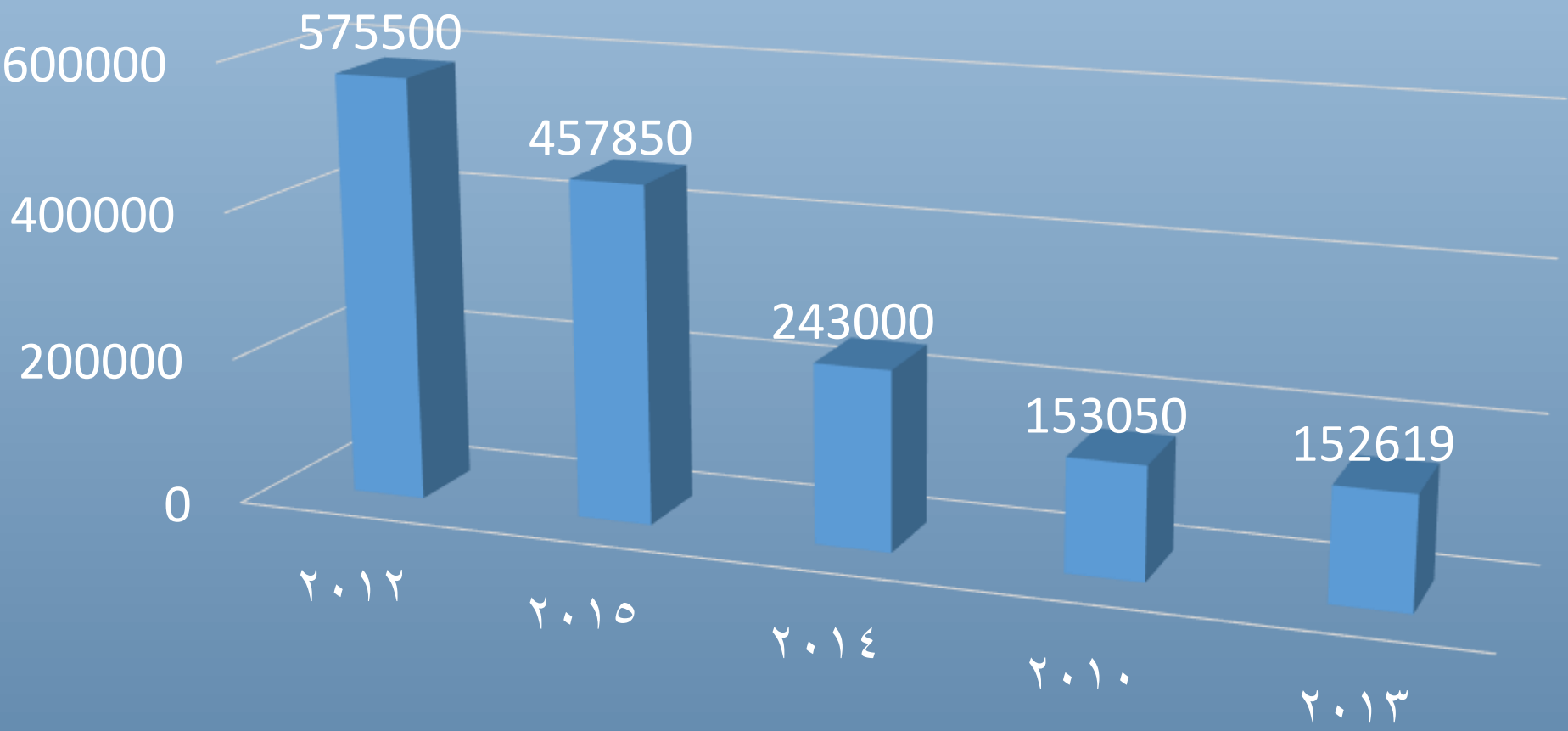


Total Fund Received Under ORG/RG TRC-programs (in OMR) per year

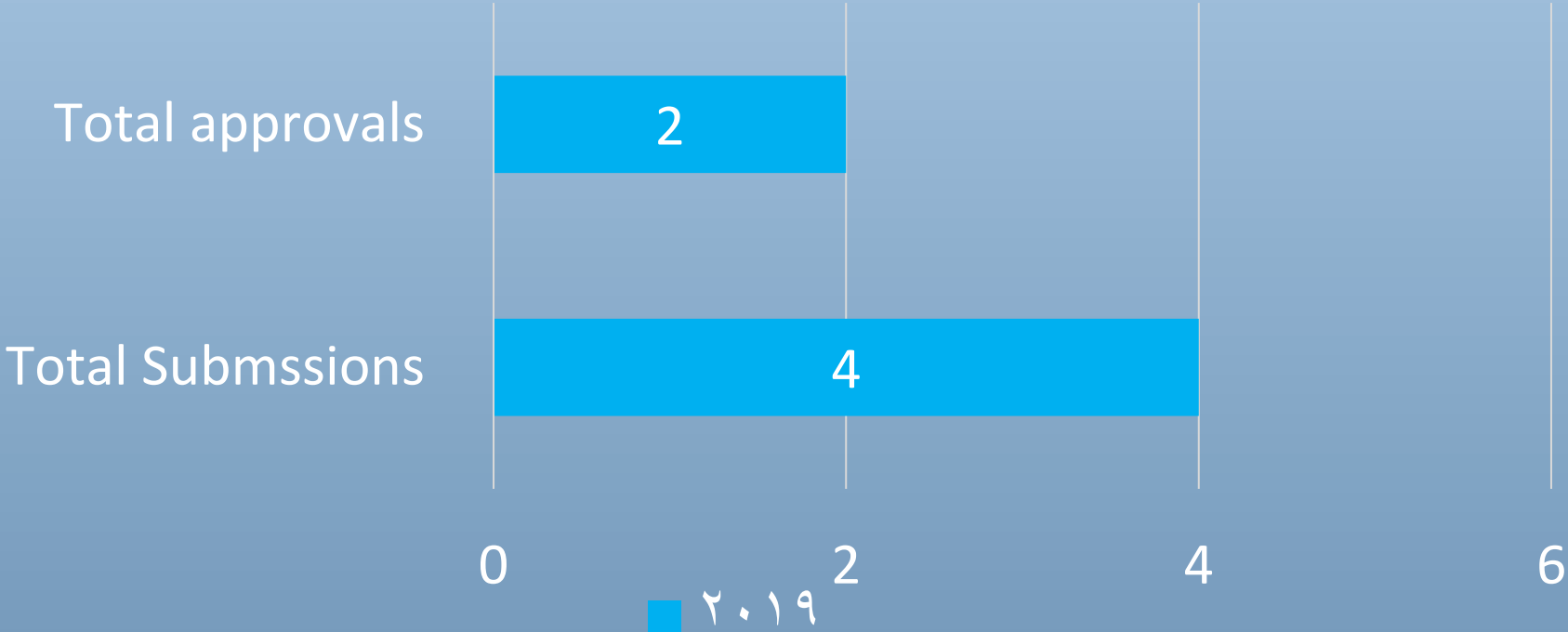




Top 5 TRC-Research Grants in OMR



Total Submitted /Approved Research Proposal
under GRG TRC-Programs in 2019



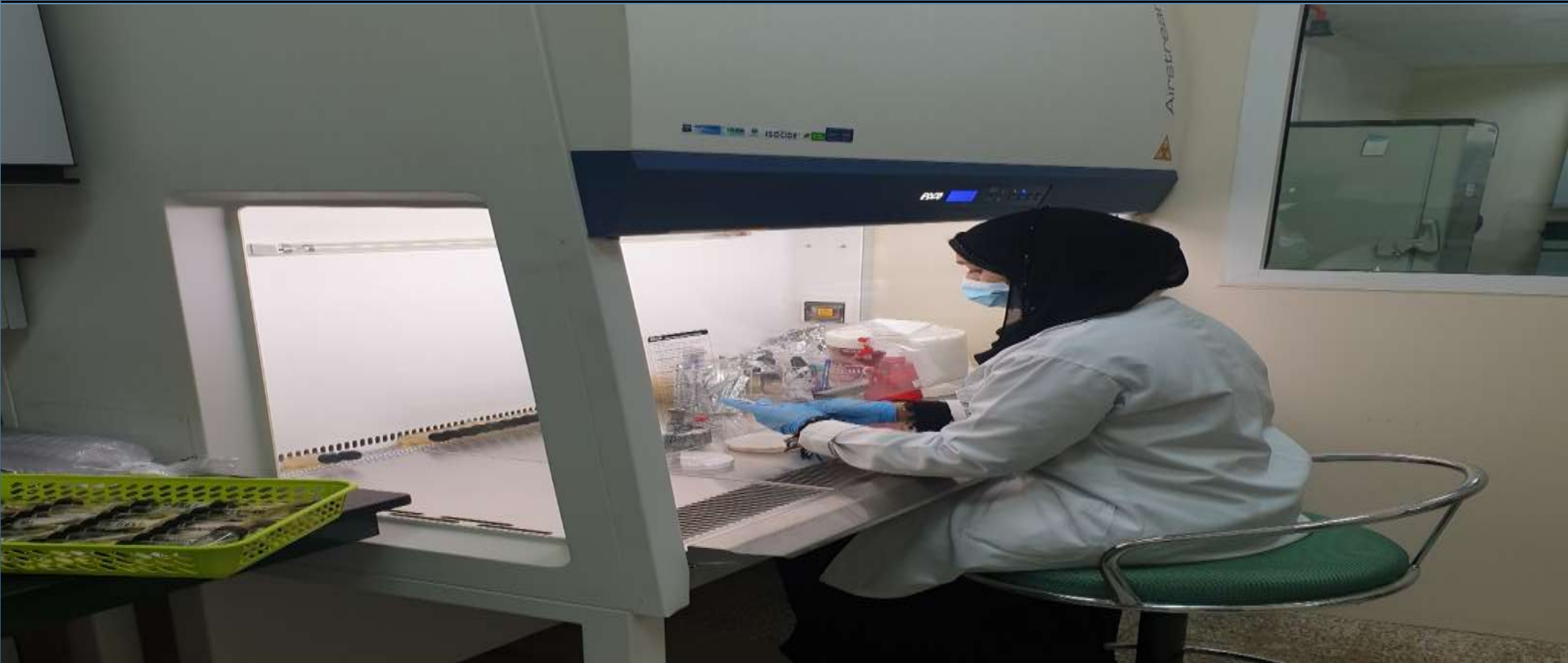
2019-Total fund 6000
OMR



Graduate Research Grants (GRG) targets young researchers that are non-PhD holders such as postgraduate students or employees. The Maximum fund under this category is 3000 OMR. University of Nizwa encourages young researchers to apply for research grants under this program.. 6 approved Grants were obtained in Under GRG in the 2019 and 2020.

Number of Undergraduates TRC-Research Grants per Academic year / College/center

Academic year	CAS	CEMIS	CEA	CPN	NCMSM	NMSRC	Total
2013/2014	2	0	1	3	3	2	11
2014/2015	8	1	1	7	8	0	25
2015/2016	5	3	2	1	6	0	17
2016/2017	1	2	0	0	0	0	3
2017/2018	1	2	0	0	0	0	3
2018/2019	2	2	2	0	5	0	11
2019/2020	٤	٠	٠	١	٠	0	5



Total Undergraduates Research Fund (in OMR)/year

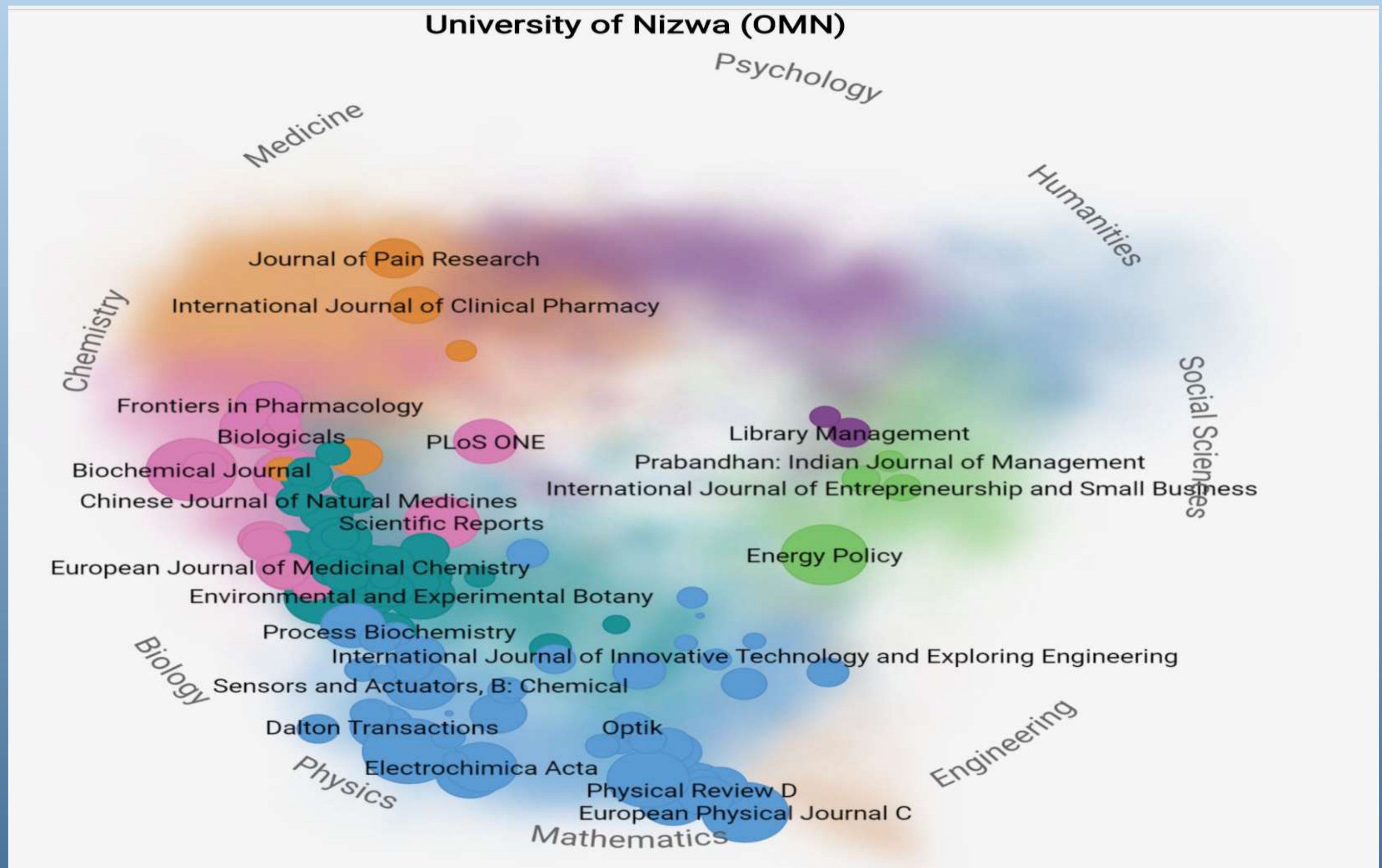


Total Received Fund under TRC Undergraduates Research Grants (URG) formerly called Faculty -Mentor Undergraduates Research Awards program (FURAP) = 157,646 OMR

Research funds /expenditures per year in OMR

	2009- 2010	2010- 2011	2011- 2012	2012- 2013	2013- 2014	2014- 2015	2015- 2016	2016- 2017	2017- 2018	2018- 2019
Total Internal Research Fund	1908647	2553453	2070091	2922507	4642539	4678383	4487591	3690142	3652603	3990802
Total External Research Fund	120182	223689	68519	623387	264459	1947536	1164613	2434589	265611	130360
Total Research Fund	2028829	2777142	2138610	3545894	4906998	6625919	5652204	6124731	3918214	4121162





<https://www.scimagoir.com/institution.php?idp=11518>

SECTION-3

RESEARCH DISSEMINATION

A significance increase in total research dissemination per year

Distribution of Journal Papers per College per year (2016/2017 – 2019/2020)

Year/college	CAS	CEA	CPN	CEMIS	Research Centers	Total
2019/2020	101	34	26	38	98	297
2018/2019	46	35	15	20	144	258
2017/2018	48	24	18	18	139	274
2016/2017	96	17	7	15	113	248

Number of Published articles /books from 2016-2020



Number of books and book chapters published per college in (2016/2017 – 2019/2020)

Year/college	CAS	CEA	CPN	CEMIS	Rresearch centres	Total
2019/2020	26	1	0	5	13	45
2018/2019	2	0	2	1	13	18
2017/2018	4	5	0	3	3	15
2016/2017	9	0	0	2	10	21

Journal Papers to Faculty Ratio by College per year (2016/2017 – 2019/2020)

	CAS	CEA	CPN	CEMIS
2019/2020	0.99	1.17	1.08	1.3
2018/2019	0.43	1.06	0.57	0.77
2017/2018	0.4	0.75	0.75	0.59
2016/2017	1.4	0.5	0.3	3

Conference papers by College/ Centers (2016/17 – 2019/2020)

Year/college	CAS	CEA	CPN	CEMIS	Research Centres	Total
2019/2020	30	11	32	19	11	103
2018/2019	18	37	7	17	25	104
2017/2018	14	41	17	6	45	123
2016/2017	12	23	0	2	26	63



SECTION-4

RESEARCH COLLABORATION

Research Collaboration

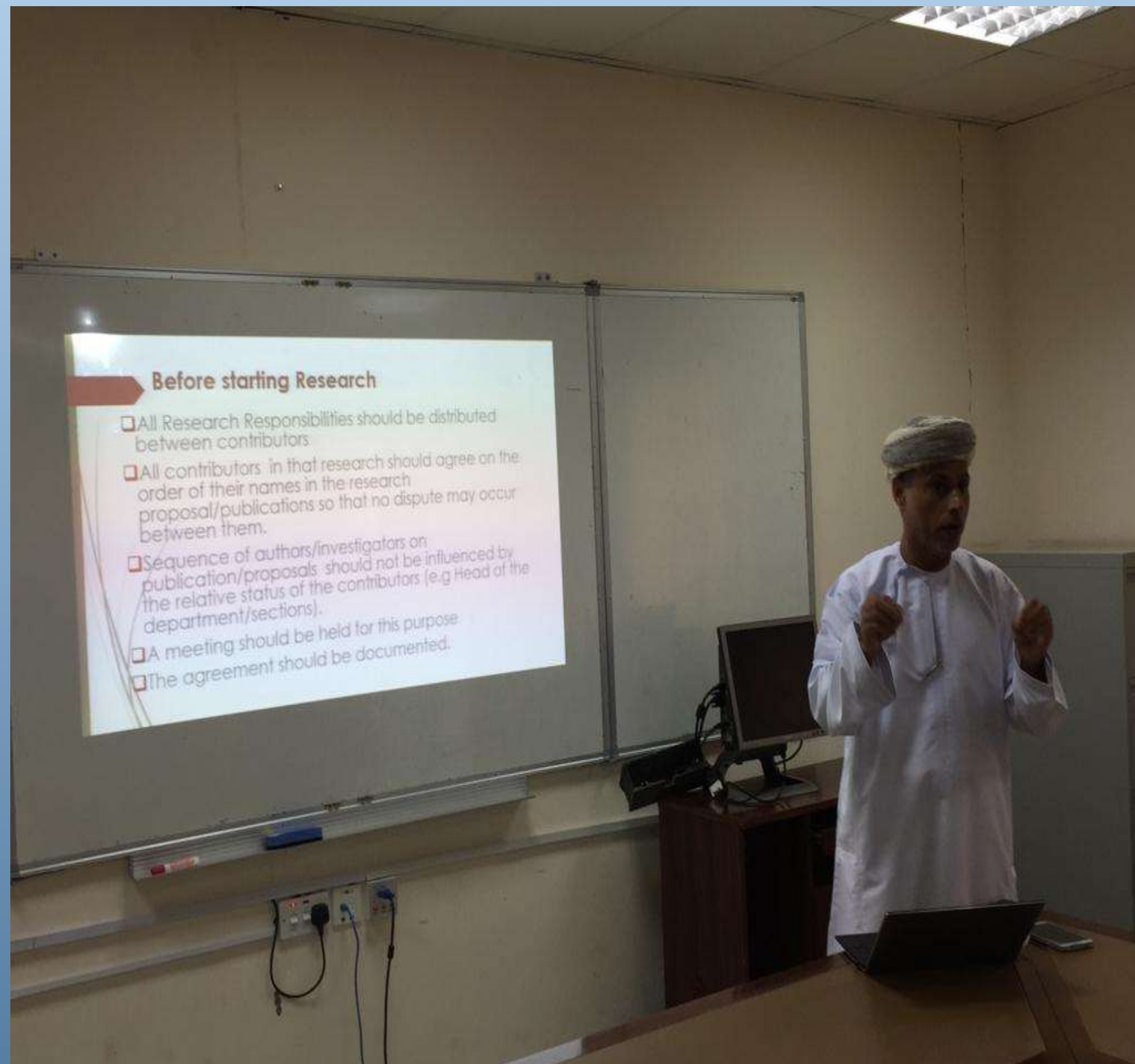


Medical Research collaboration between Oxford University and the UoN (NMSRC). Started with Research student exchange and currently collaborated research project.

College/ center	No. of International Collaborators	No. of International Affiliations	Areas/s of collaborations
NMSRC	59	54	❖ Pharmacy ❖ Natrual Products, Endophytes, marine samples, synthesis ❖ PCMD
CPN	3	3	❖ In-vivo studies on nanoformulations ❖ Medication safety education through games ❖ Systematic review in the field of 'perception and satisfaction of public/patients on the roles and responsibilities of pharmacists'
CAS	37	37	❖ Research Collaboration
Al Khalil Center	1	1	❖ Al-wqāf (Islamic Endowments) in Oman

Collaboration for PhD student's Supervision

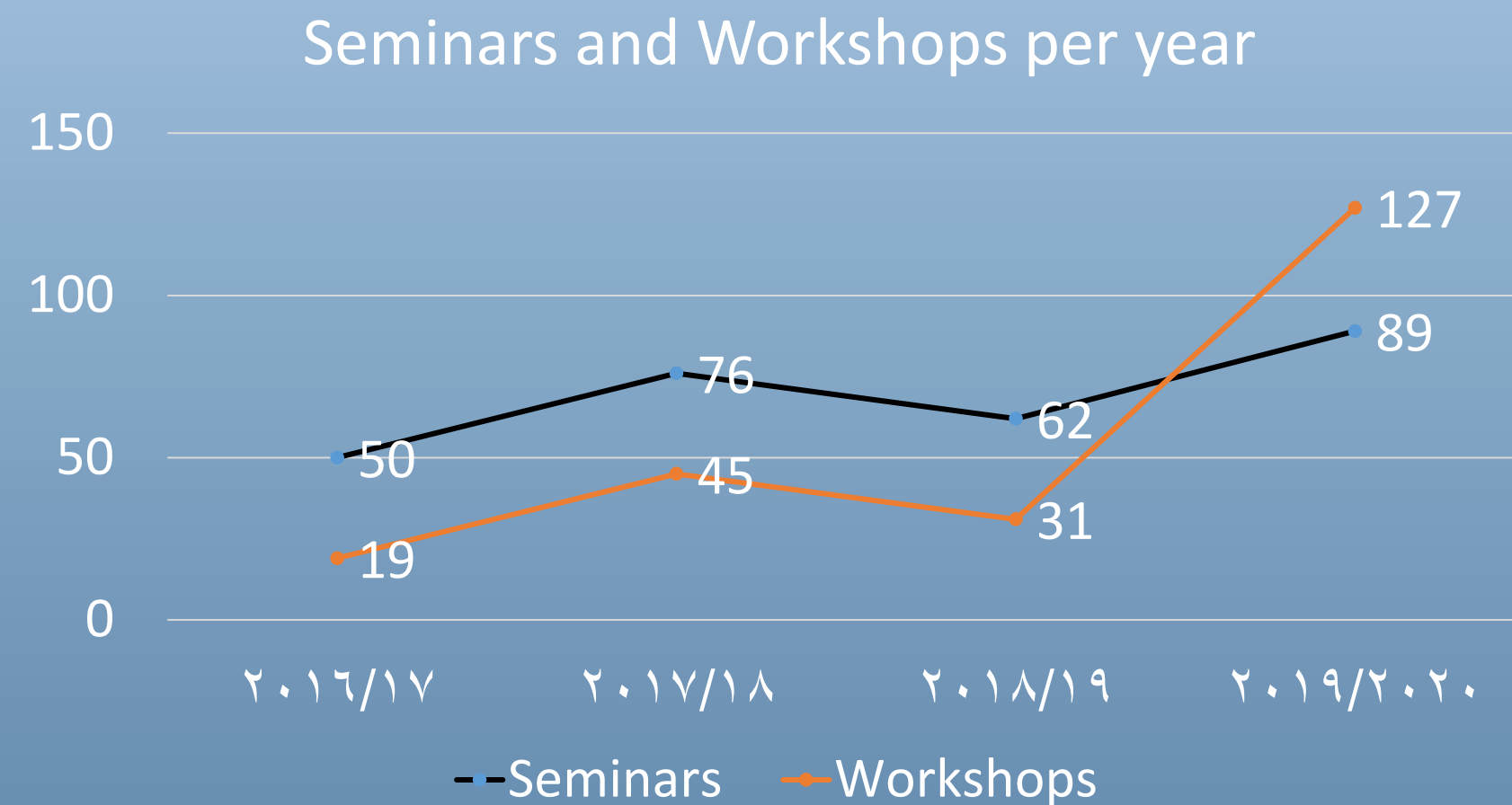
Supervisor Name	No of Students	Country	Area of the Study
Dr Muhammad Usman Anwar	2	Pakistan	Chemistry
Dr Abdul Latif Khan	3	Pakistan	Plant Sciences
Dr Hidayat Ullah	1	Pakistan	Isolation and synthesis
Dr. Ajmal Khan	2	Pakistan	Enzyme inhibition and medicinal chemistry
Dr.Sabin Thomas	1	Malaysia	Pharmacy Practice
Total	9		



SECTION-5

OTHER RESEARCH ACTIVITIES: Seminars and workshops

Other research activities: UoN is committed to enhance capacity building for students and staff, therefore, a significant number of training courses and seminars were offered



Year/college	CAS		CEA		CPN		CEMIS		Research Centers		Total	
	Seminars	Workshops	Seminars	Workshops	Seminars	Workshops	Seminars	Workshops	Seminars	Workshops	Seminars	Workshops
2016/17	6	2	13	1	7	2	7	2	17	12	50	19
2017/18	3	1	24	2	5	14	12	6	32	22	76	45
2018/19	10	0	10	9	7	8	9	8	35	9	62	31
2019/2020	10	26	26	34	32	40	8	9	13	18	89	127



SECTION-6

Research at Glance

A Transcriptomic analysis of Dubas bug (*Ommatissus lybicus* Bergevin) infestation to Date Pal. Abdul Latif Khan, Sajjad Asaf, Adil Khan, Arif Khan, Mohammad Imran, Ahmed Al-Harrasi¹, In-Jung Lee, Ahmed Al-Rawahi, Natural and Medical Sciences Research Center

OPEN Transcriptomic analysis of Dubas bug (*Ommatissus lybicus* Bergevin) infestation to Date Palm

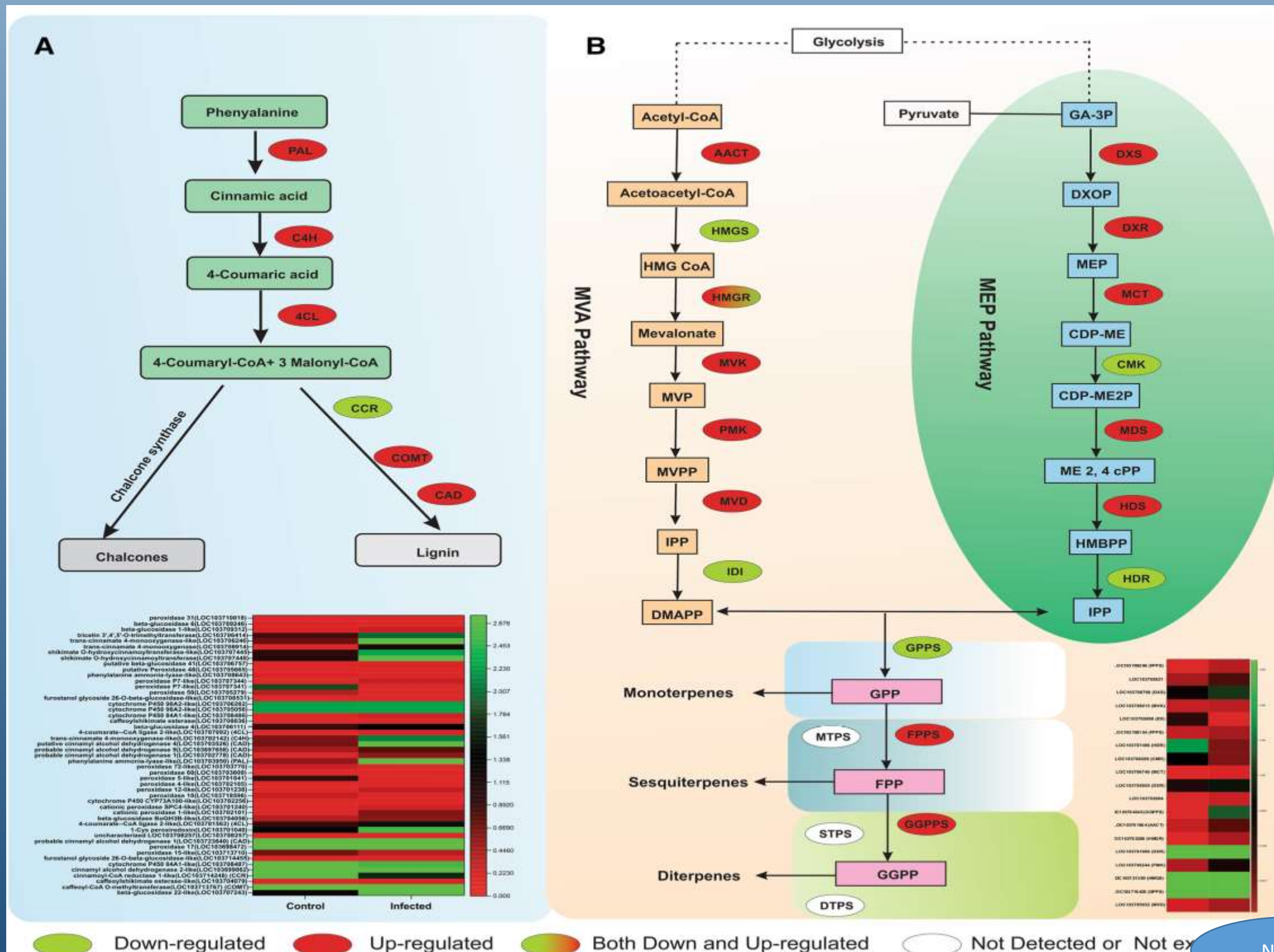
Abdul Latif Khan^{1,4,✉}, Sajjad Asaf^{1,4}, Adil Khan^{1,4}, Arif Khan², Muhammad Imran³, Ahmed Al-Harrasi^{1,✉}, In-Jung Lee³ & Ahmed Al-Rawahi¹

Date palm (*Phoenix dactylifera* L.) and its fruit possess sociocultural, health and economic importance in Middle East. The date palm plantations are prone to Dubas bug (DB; *Ommatissus lybicus* DeBergevin; Homoptera: Tropiduchidae) attacks that severely damages the tree's growth and reduces fruit production. However, the transcriptome related datasets are not known to understand how DB activates physiological and gene regulatory mechanisms during infestation. Hence, we performed RNA-Seq of leaf infected with or without DB to understand the molecular responses of date palm seedlings. Before doing that, we noticed that DB infestation significantly increase superoxide anion and malondialdehyde production to two-folds as compared to healthy control. Stress-responsive genes such as *proline transporter 2*, *NADP-dependent glyceraldehyde* and *superoxide dismutase* were found significantly upregulated in infected seedlings. The infection repercussions were also revealed by significantly higher contents of endogenous phytohormonal signaling of jasmonic acid (JA) and salicylic acid (SA) compared with control. These findings persuaded to dig out intrinsic mechanisms and gene regulatory networks behind DB infestation to date palm by RNA-Seq analysis. Transcriptome analysis revealed upregulation of 6,919 genes and down-regulation of 2,695 genes in leaf during the infection process. The differentially expressed genes were mostly belongs to cellular functions (calcium and MAPK), phytohormones (auxin, gibberellins, abscisic acid, JA and SA), and secondary metabolites (especially coumarinates and gossypol). The data showed that defense responses were aggravated by gene networks involved in hypersensitive responses (*PAR1*, *RIN4*, *PBS1* etc.). In conclusion, the results revealed that date palm's leaf up-regulates both cellular and phytohormonal determinants, followed by intrinsic hypersensitive responses to counter infestation process by Dubas bug.

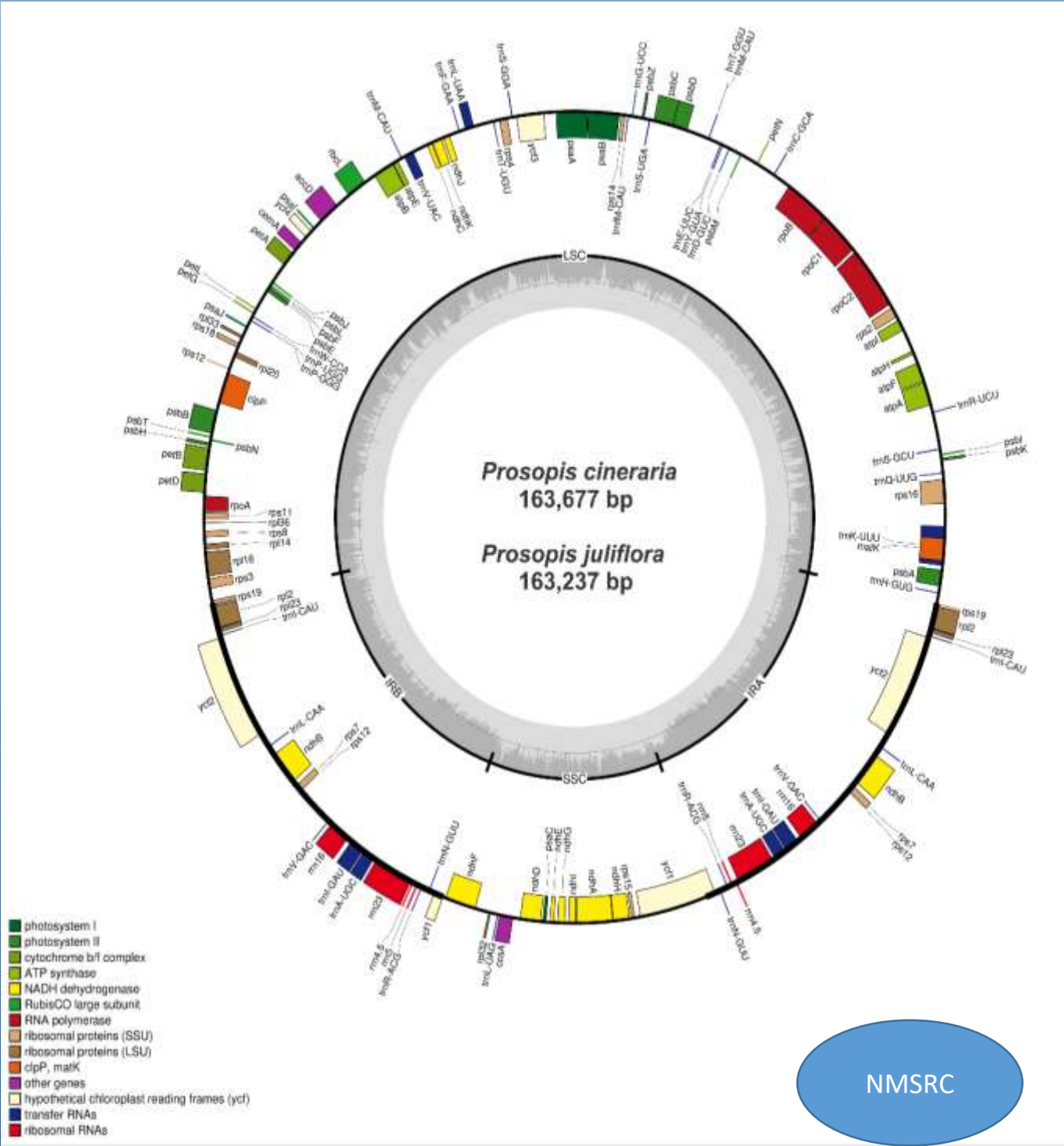
Date palm (*Phoenix dactylifera* L.) is one of the oldest fruits crop and has played particularly important role in the culture, economy and well-being of the people of Arabian region¹. It is widely grown in arid and semi-arid region, and distributed across 24 countries². The fruit is an important part of dietary intake due to its significant nutritional values. Like other countries in Arabian Peninsula, there are more than 300 date palm cultivars in Oman—the 8th largest producers of date fruits. Although with improved breeding and tissue culture technologies, highly resistant varieties are cultivated in oasis, however, still the tree is confronted with pathogenic and insect attacks, hence reducing its growth, yield and production^{3,4}. The literature shows that date palm fruit decline significantly due to the attack of Dubas bug (*Ommatissus lybicus* Bergevin, Homoptera: Tropiduchidae) in the Middle East and North Africa, which is considered a major pests³⁻⁵.

Dubas bug (DB) was identified by Blumberg for the first time in the Tigris-Euphrates River Valley. Later on, he claimed that DB spread from its primary origin to other regions^{3,4,7}. During active period, Dubas bug nymphs hatch and feed on the nutrient sap of the leaf⁶. Nymphs pass through five growth instars^{8,9}, with adult female DB grows to 5–6 mm and males to 3–3.5 mm in length^{10,11}. Two populations of DB are produced each year. The summer generation of nymph's hatch in mid to late April. While feeding, the insect produces excreta in the form of honeydew on the leaflets and accumulates on top of the leaf—a shining droplet full of sugar and

¹Natural and Medical Sciences Research Center, University of Nizwa, 616, Nizwa, Oman. ²Genomics Group, Faculty of Biosciences and Aquaculture, Nord University, 8049 Bodø, Norway. ³School of Applied Biosciences, Kyungpook National University, Daegu, South Korea. ⁴These authors contributed equally: Abdul Latif Khan, Sajjad Asaf and Adil Khan. [✉]email: latifepm78@yahoo.co.uk; aharrasi@unizwa.edu.om



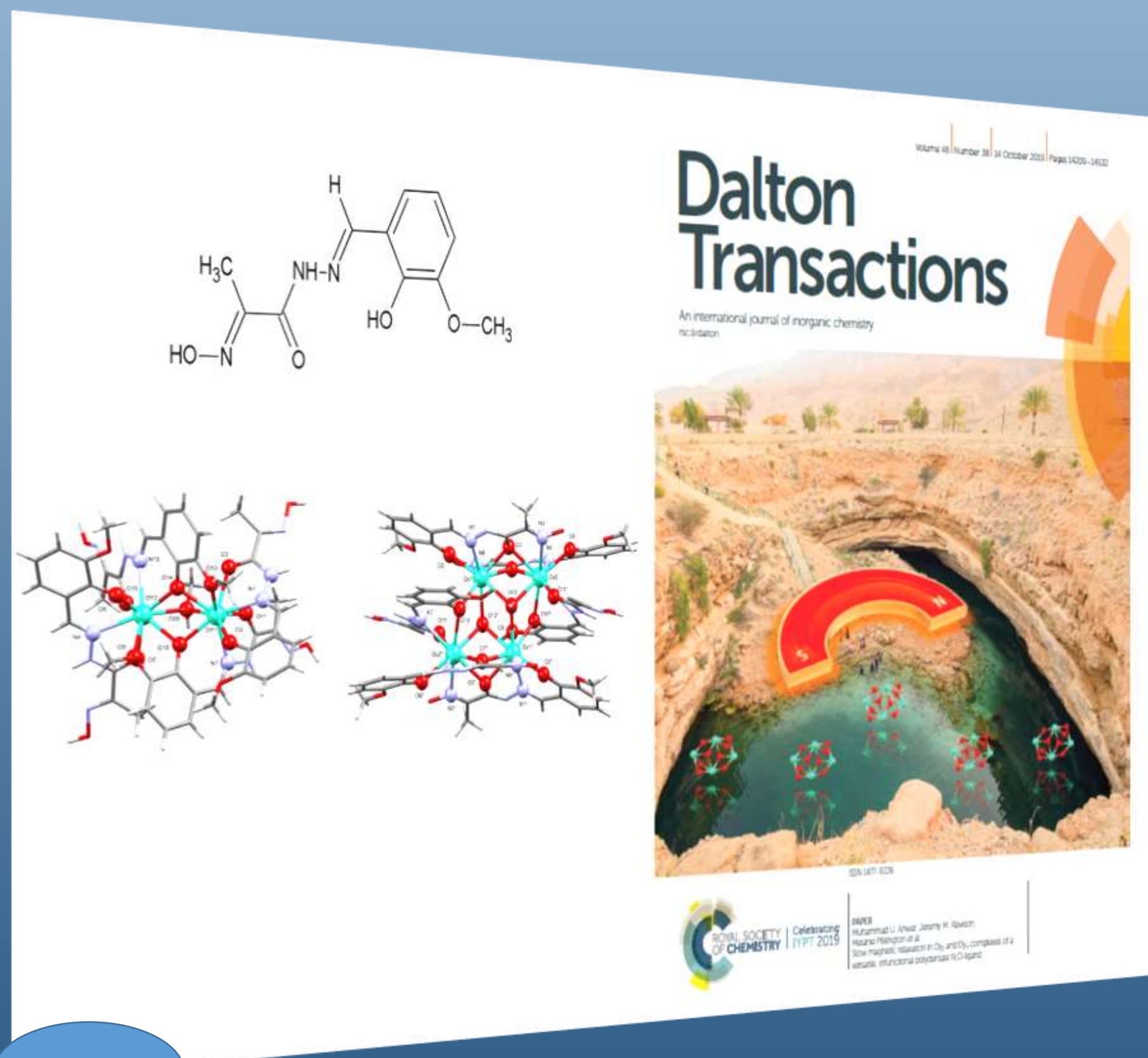
Unraveling the chloroplast genomes of two *Prosopis* species to identify its genomic information, comparative analyses and phylogenetic relationship, Sajjad Asaf , Abdul Latif Khan Arif Khan , and Ahmed Al-Harrasi



Genus *Prosopis* (family Fabaceae) are shrubby trees, native to arid and semi-arid regions of Asia, Africa and America and known for nitrogen fixation. Here, we have sequenced the complete chloroplast (cp) genomes of two *Prosopis* species (*P. juliflora* and *P. cineraria*), compared them with previously sequenced *P. glandulosa*, *Adenanthera microsperma*, and *Parkia javanica* belonging to the same family. The complete genome sequences of *Prosopis* species and related species ranged from 159,389 bp (*A. microsperma*) to 163,677 bp (*P. cineraria*). The overall GC contents of the genomes were almost the similar (35.9%-36.6%). The *P. juliflora* and *P. cineraria* genomes encoded 132 and 131 genes, respectively, whereas both the species comprised of 85 protein-coding genes – higher than other compared species.

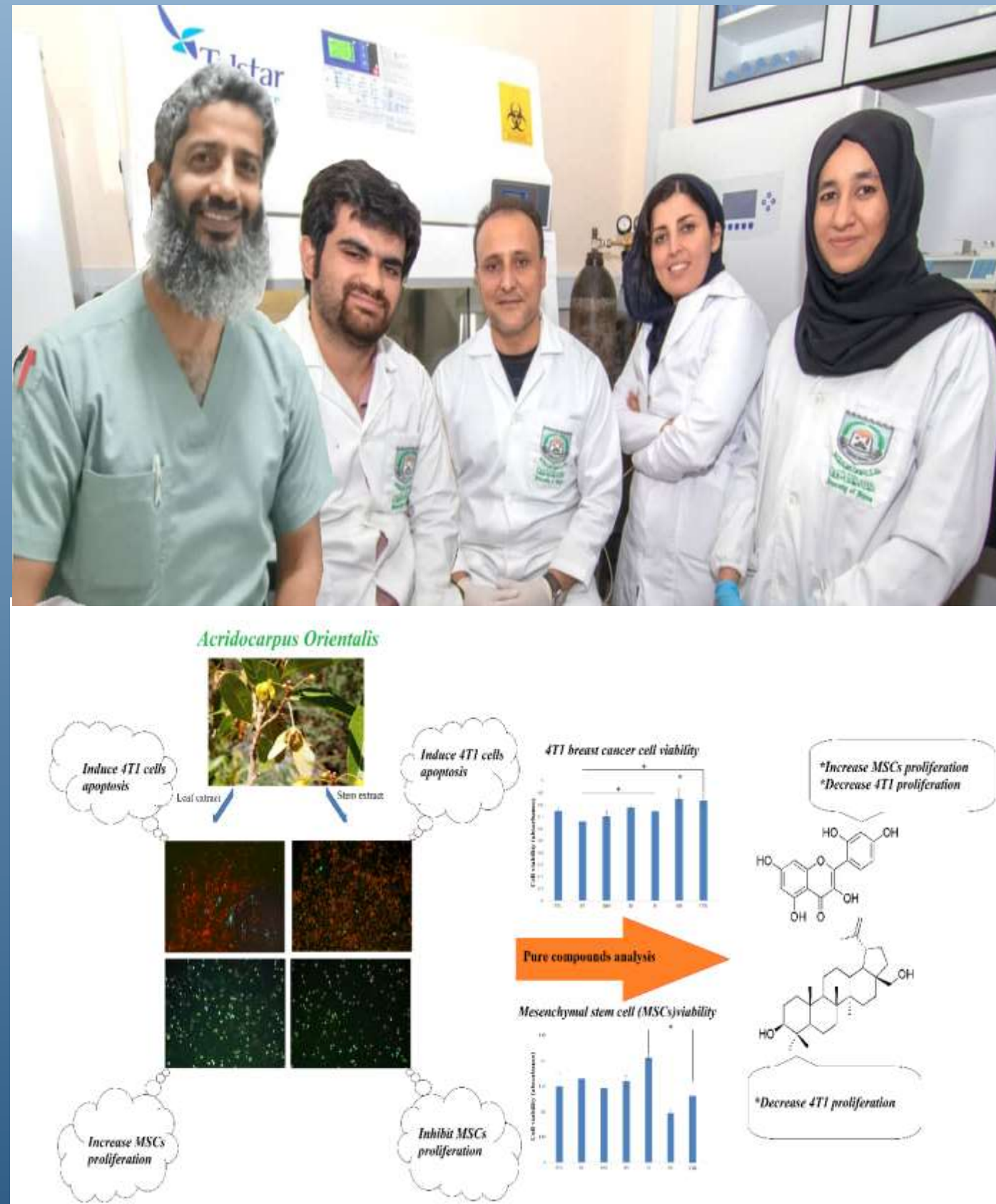
About 140, 134 and 129 repeats were identified in *P. juliflora*, *P. cineraria* and *P. glandulosa* cp genomes, respectively. Similarly, maximum number of simple sequence repeats were determined in *P. juliflora* (88), *P. cineraria* (84) and *P. glandulosa* (78). Moreover, complete cp genome comparison determined a high degree of sequence similarity among *P. juliflora*, *P. cineraria* and *P. glandulosa* however, some divergence in the intergenic spacers of *A. microsperma* and *Parkia javanica* were observed. The phylogenetic analysis showed that *P. juliflora* is closer to *P. cineraria* than *P. glandulosa*.

Dysprosium Single Molecule Magnets, Muhammad Usman Anwar, NMRC



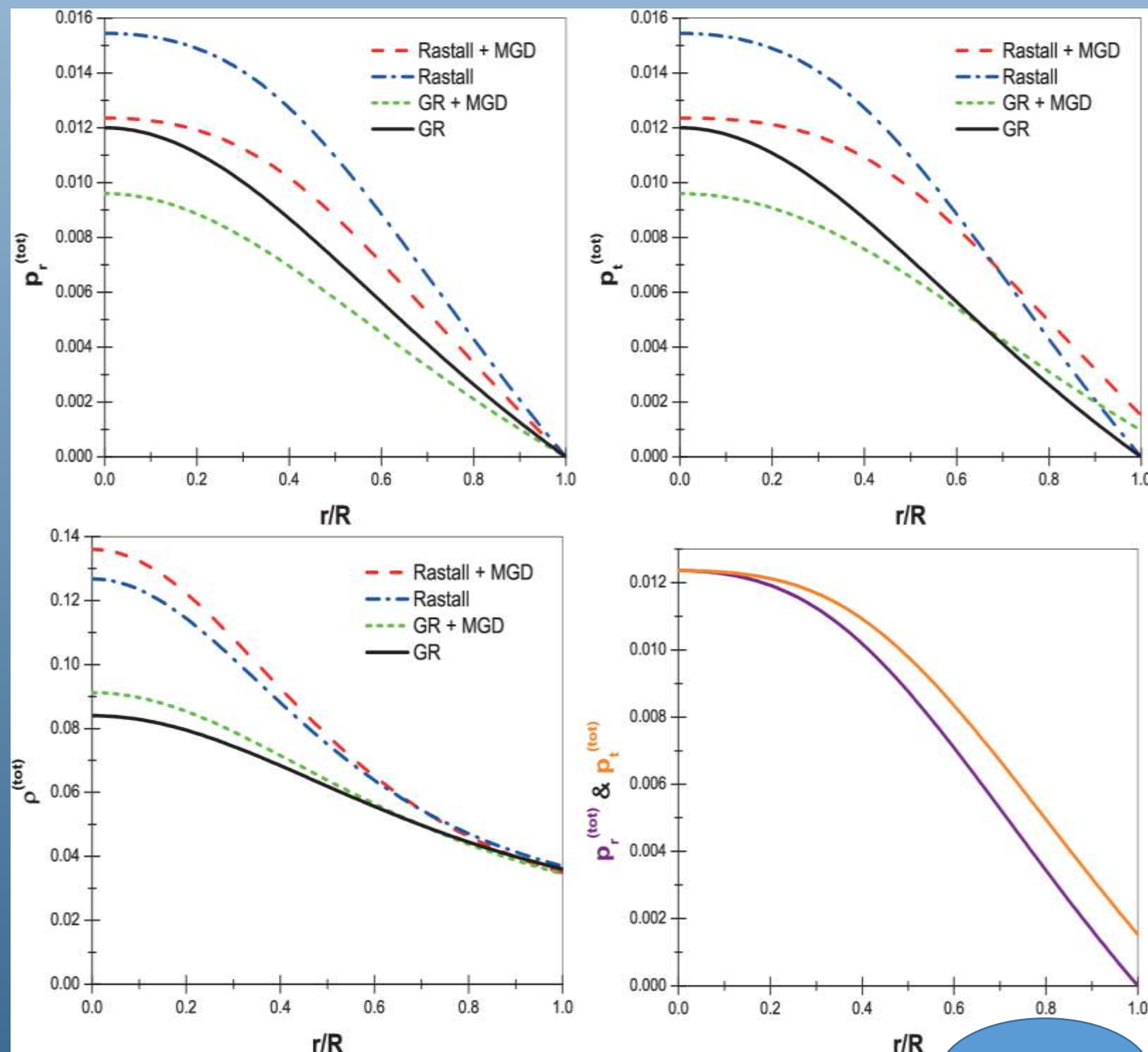
Magnets have a large number of applications such as, computer hard drives, memory cards etc. The drawback of the current material used for storing information is the limit to their size because of the free fluctuations in the particles for the size of 10 – 100 nm. The potential solution is provided by Single-Molecule Magnets (SMMs) containing transition metal and Lanthanides ions. SMMs offers a diverse range of potential applications in ultra-high density storage devices, sensors, nano-electronics and molecular spintronics. We synthesized a tridentate ligand comprising o-vanillin, hydrazone and oxime donor. This ligand exhibits a diversity of bonding motifs and acidic protons, providing a flexible polydentate framework capable of stabilizing multiple Lanthanide ions and offering a diversity of charge-balancing states. Careful tuning of the pH of the reaction mixture permitted the isolation of a series of lanthanide complexes. The magnetic studies reveal that dysprosium complexes are single molecule magnets, exhibiting slow relaxation of magnetization under zero and applied field. Our work was published in Dalton Transaction Journal and was highlighted on the cover page).

Secondary Metabolites from *Acridocarpus orientalis* inhibits 4T1 cells and promotes mesenchymal stem cells (MSCs) proliferation. Laboratory for stem cell & Regenerative



Among medicinal plants, *Acridocarpus orientalis* (AO) possesses a remarkable anti-cancer potential, possibly because of its anti-oxidant property. In this study, the leaf and stem extracts from AO were assessed to find the bioactive compound with selective anti-cancer properties. The MTT viability and live and dead assays revealed that around 80% and 98% of 4T1 cells survival were declined after 48 hrs incubation with leaf and stem extracts, respectively. Bone marrow-derived mesenchymal stem cells (MSCs) were applied to investigate the cytotoxicity and stem cell-inductive properties of AO extracts. The leaf extract increased stem cell proliferation by 20 % whereas the stem extract inhibited around 22 % of stem cells proliferation after 48 hrs treatment. The live and dead assay of MSCs confirmed that 40 % of the MSCs died when treated with AO stem extract. On the other hand, there were no dead cells after two days of treatment with the leaf extract. Followed by the induction of cell cycle arrest in G0/G1-phase, the real-time PCR demonstrated apoptosis properties in 4T1 cells through overexpression of Bax and down-regulation of *BCL2* genes. Interestingly, within the pure compounds isolated from AO leaf extract, Morin was responsible for the inhibition of 4T1 cells proliferation as well as MSCs expansion, predicting to play an essential role in the treatment of cancer. The promising *in vitro* anti-cancer and stem cell-inductive properties of morin isolated from AO extract may provide a great potential to produce selective herbal derived drugs.

Decoupling gravitational sources by MGD approach in Rastall gravity, S. K. Maurya, CAS



CAS

In the present work, we investigate the possibility of obtaining stellar interiors for static self-gravitating systems describing an anisotropic matter distribution in the framework of Rastall gravity through gravitational decoupling by means of minimal geometric deformation approach. Due to Rastall gravity breaks down the minimal coupling matter principle, we have provided an exhaustive explanation about how Israel-Darmois junction conditions work in this scenario. Furthermore, to obtain the deformed space-time, the mimic constraint procedure has been used. In order to check the viability of this proposal, we have applied it to the well known Tolman IV solution. A complete thermodynamic description of the effects introduced by the additional source is given. Additionally, the results have been compared with their similes in the picture of pure general relativity, pure Rastall gravity and within the framework of general relativity including gravitational decoupling.

Global Entrepreneurship Monitor (GEM),

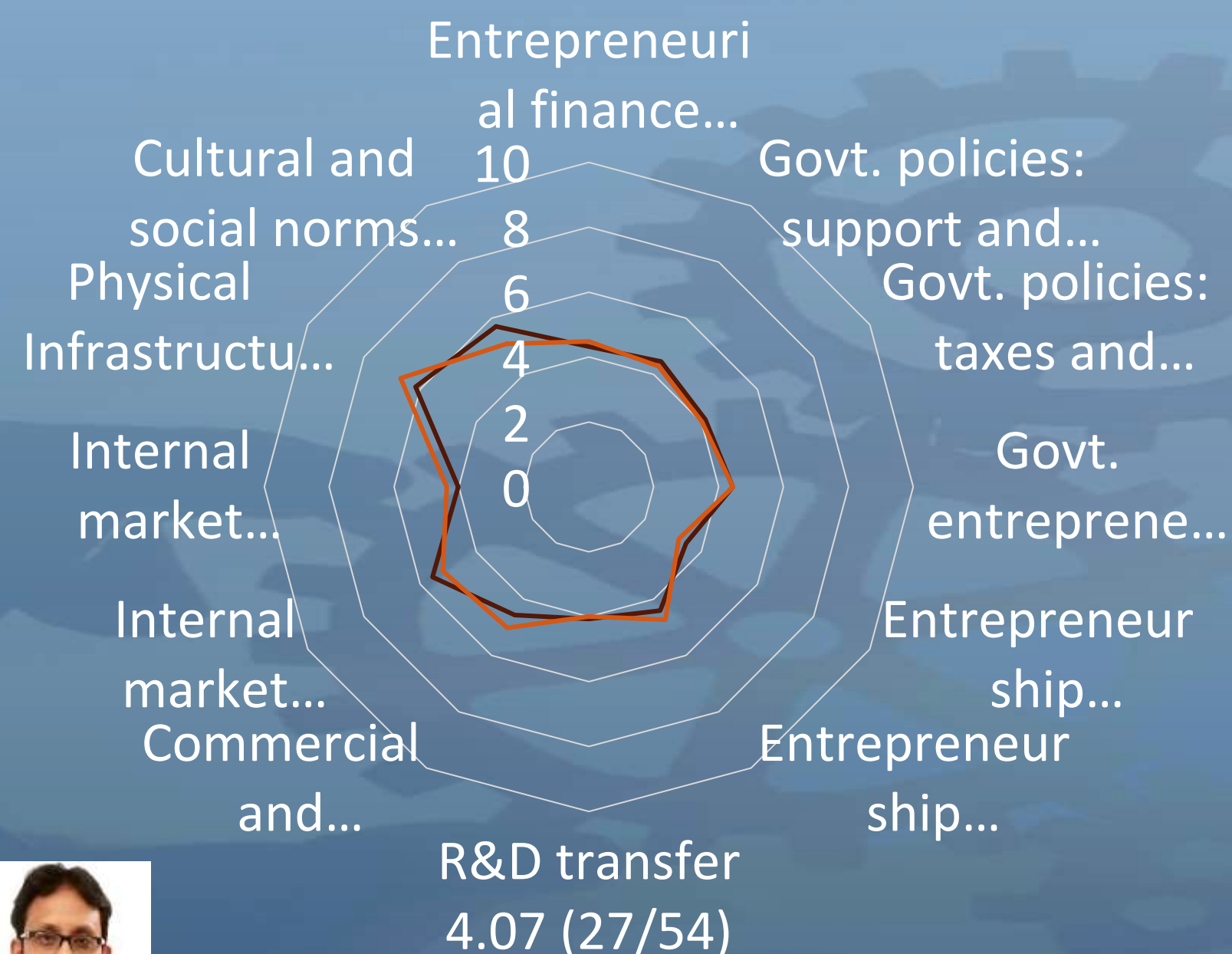
Abdullah AlShukaili, Norizan Mohd Kassim, Bader AlSuleim, Swadhin Mondal, Yasmeen Kausar, Zunaith Ahmed,
CEMIS

—Oman —GEM

2019/2020 Global Report



GEM team-Oman



The Oman National Team became a member of Global Entrepreneurship Monitor (GEM) in May 2019. The team has completed the Oman GEM National Report 2019-20. Two important surveys were conducted (i) the 2000 Adult Population survey across Oman: The rates of entrepreneurship across multiple phases and assessed the characteristics, motivations, activity, impact, and ambitions of entrepreneurs, as well as the attitudes of the Omani society toward such activity as compared with other 50 economies. (ii) The expert ratings of the entrepreneurial framework conditions show the quality of the entrepreneurship context through a National Experts Survey (NES), where twelve pillars of the national framework conditions are scored by a selected sample of experts from 0 (very insufficient) to 10 (very sufficient).

CEMIS

Project Title: Healthcare Expenditure, Infrastructure Development and Health Outcome Nexus: Exploring the Evidence from Oman. Dr. Swadhin Mondal (PI), Mr. Mohammed Al-Azri, Dr. Kausar Yasmeen, Mr. Shamsudheen A.T and Ms. Fatema AL-Mamari.

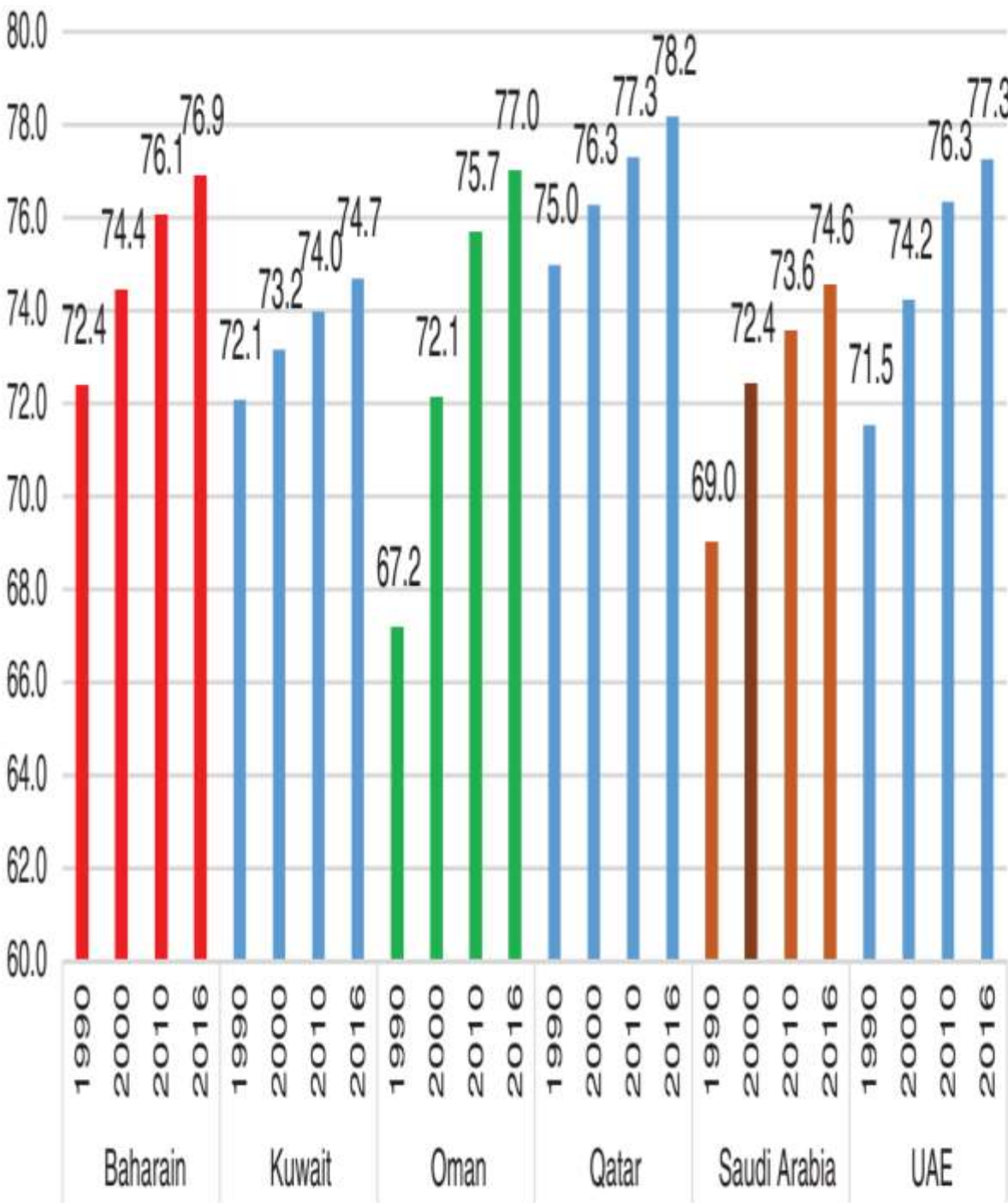


FIGURE 1 Progress of life expectancy rate in GCC countries during 1990-2016. Source: World Bank World Development Indicators

- The team has recently conducted an exit patient survey from Nizwa Hospital for estimating out-of-pocket expenditure for healthcare and find out the major influencing factors for preferring treatment abroad. The team has also analyzed secondary level data and published a research paper in an international impact factor journal.

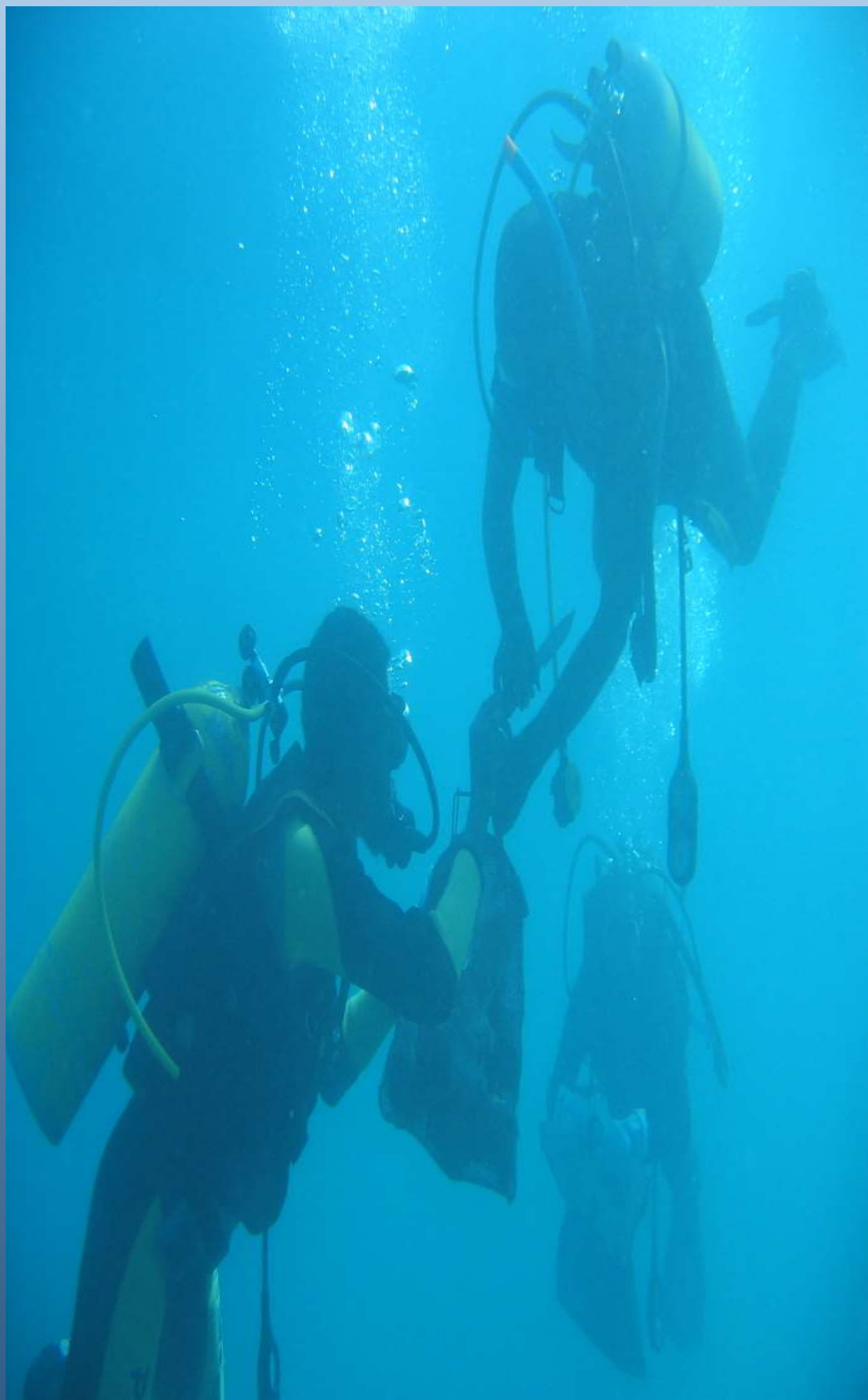
The study found that over that past few decades, public health expenditure has a significant impact in reducing infant mortality rate, under 5 children mortality rate and maternal mortality rate in Oman. The study also found that both public and private health expenditure have played an important role in controlling non-communicable diseases (NCDs). However, private expenditure has bigger role in reducing death due to NCDs as compared to public expenditure. The study estimated the average out-of-pocket spending (OOPS) through exit-patient interviews—OOPS for out-patient department (OPD) is 21.4 OMR and for in-patient department (IPD) 4.9 OMR; in treatment abroad it is 790 OMR. The OOPS for OPD compared to IPD is quite high because 18 percent of OPD patients have visited private hospital for diagnostic test. The study also found that 60 percent of IPD patients visited outside the country for medical treatment and the major influencing factors for preferring treatment from abroad are the unavailability of specialized doctors, poor diagnostic systems, and long waiting times to get treatment.

Development of a continuous flow solar disinfection system for treated wastewater,

Sreedhar Reddy, Salam Al Dawery, and Anwar Ahmed



This research project aims to develop a continuous flow solar disinfection system to inactivate coliform organisms present in treated wastewater. The efficacy of the SODIS process has been studied for the inactivation of the widely used indicator microorganism *Escherichia coli*, using a continuous-flow solar disinfection unit for different irradiance and temperature conditions. The SODIS unit disinfected more than 99 percent of *E. Coli* present in the treated wastewater. The introduction of a SODIS unit after traditional WWTP processes greatly increases the capacity for re-use of treated wastewater.



Discovery of anticancer metabolites from Oman Marine Invertebrates,

Sadri Said, Mohammed Sohail Akhtar, Sergey Dobretsov , Sommaya Al Riyami, Ahlam AlAbri

Natural products are among the major sources of new chemical entities for drug development.. Recent recognition of marine environment as an exceptional reservoir of bioactive natural products and advances in diving technology have prompted intensified searches for medicinal useful natural products from marine sources. In the last five decades several pharmacological active natural products have been isolated from marine organisms especially marine sponges, tunicates and microorganisms. Compounds exhibiting antiviral, antifungal, anti-inflammatory, antitumor and cytotoxic properties have been obtained from marine biota. A large number of marine natural products are currently in the preclinical and clinical stages of development and few of them have been approved for clinical use Each year an increasing number of novel bioactive marine natural products are reported in the literature. indicating that marine environment is likely to continue to be a prolific source of new bioactive natural products for many years to come. The present investigation is aimed to discover anticancer compounds from invertebrates inhabiting Oman seas. .



Aflaj Unit Research activities

Project 1. Historical Changes in Land Use in the Aflaj and Future Trends

This project is funded by The Sultan Qaboos Higher Center for Culture and Science (SQHCCS) On-going since 2016.

Using historical and current satellite imagery, this projects documents the changes in land use that have occurred in the aflaj from the mid-1970s to the present day, and determines the factors responsible for changes in land use.

Project 2. Documenting Traditional Knowledge in Falaj Construction and Maintenance. This Project is funded by The Sultan Qaboos Higher Center for Culture and Science (SQHCCS) On-going since 2016 .

The project aims to document the method of constructing and maintaining Daudi Aflaj. This is done first by interviews with those with the expertise regarding how to maintain Daudi Aflaj, as well as documentation of the tools and methods used.

Al-Khalil Center Research activities

"Cultural and educational relationships between Sultanate of Oman and Republic of France", a research, Dr Suleiman Al-Husseini. Presented on the Omani-European Press Forum, "Bridges of Journalistic, Literary and Artistic Communication", UNESCO, 2019



Al-Khalil
center

The research is a pioneering endeavour to shed a light on contemporary cultural and educational relationships between Oman and France. It explores aspects of cultural and educational cooperation, the treaties governing them, the organizations and institutions in charge of such activities and chances of future developments.

The study argues that Oman-France contemporary cultural and educational relationships are underpinned by robust political relationships, governed and supervised by agreements and legislations and run by national institutions and organisations on both countries.

At educational level, French is taught as a language and a major in Omani universities and schools. University of Nizwa is one of the Omani higher education institution in which French is provided at BA level. The University cooperate with Cavilam in France and with the French Embassy in Muscat to provide training for its students.

"Centre Franco-Omanis" , in Muscat, establishes and foster educational and cultural ties between the people of the two countries. The Centre runs language and cultural activities and provide support to private and public schools and universities in Oman who teach French as a foreign language. Other institutions that benefit from such relationships are Ministry of Education, SQU and French School in Muscat.

The study also points out the historical importance of (Musee Franco-Omanains) and its cultural and educational roles. The study also discusses the cooperation between French Universities and Ministry of Heritage and Tourism in archaeological projects in Oman.

The study recommends that such unique and constructive cultural and educational relationships between Oman and France should be sustained and improved and more cooperation at university and higher education level should be encouraged.

