



AMITY UNIVERSITY

A RESEARCH & INNOVATION DRIVEN UNIVERSITY **GRADE A+ ACCREDITED BY NAAC**

ANNUAL REPORT

2021

**Amity Science, Technology & Innovation
Foundation
(ASTIF)
&**

**Amity Directorate of Science &
Innovation (ADSI, AUUP)**

**A Journey towards
Research Excellence**

Message from Founder President



“I breathe Innovation; I dream innovation and ensure that our outcome-based research and innovation ecosystem enable us to achieve ever rising benchmarks of success”

In persuasion and implementation of my vision of making Amity University a Research and Innovation driven University, and one of the world’s topmost university, Amity Science, Technology & Innovation Foundation (ASTIF) and Amity Directorate of Science & Innovation (ADSI) were created in 2008 and 2014 respectively. Both ASTIF & ADSI are constantly working to facilitate, support and augment outcome-based approach to nurture the research and innovation initiatives undertaken in the Amity universities. With great pride and happiness, I would revisit with satisfaction the milestones achieved by my faculty members and researchers in the last one year which have been brought out in the 6th Annual report prepared by ASTIF/ ADSI.

I have always envisioned my universities touching new horizons of research and innovation and I am proud to state that my people – the Vice- Chancellors, Pro Vice Chancellors, HoDs, HoIs, Faculty Members, Scientists, Researchers and Students and every member of the team, even during the unprecedented and very difficult situation of Covid-19 Pandemic were working day and night with extraordinary zeal, devotion, hardwork and positive approach to achieving exponential growth in terms of Projects, Patents, Publications, Technology development and Awards and contributing in making my dream and vision a reality.

These countless efforts, extraordinary zeal and hard work was also recognized by the Indian Intellectual Property Office under the Department for Promotion of Industry & Internal Trade (DPIIT), Ministry of Commerce & Industry, Govt. of India by conferring Amity University for National Intellectual Property Award – 2020: Top Indian Academic Institution for Patents & Commercialization.

We have done immensely well this year and this is the time to look forward and compete with our own selves. We must propel ourselves and increase our efforts multifold to achieve higher targets set at Individual, Institutional and University level and must strive to make our knowledge, technologies and products available to the society for meeting the industrial and societal needs.

I proudly would like to congratulate all Amitians for creating and implementing strategies with an endeavour for extraordinary & augmented research outcome. I am confident that with your constant efforts and determination, Amity will surely reach the position of one of the best in the world sooner than expected.

Dr. Ashok K. Chauhan
Founder President
Ritnand Balved Education Foundation

Preface

It is my proud privilege to put forth the Sixth Annual Report of Amity Science, Technology & Innovation Foundation (ASTIF) & Amity Directorate of Science & Innovation (ADSI) giving a glimpse of major milestones achieved by Amity University in the field of research and innovation during the year 2021 (Jan- Dec). Our deepest gratitude and thanks to Honorable Founder President, Dr. Ashok K. Chauhan for his exemplary leadership coupled with great vision, constant motivation, guidance, support and blessings without which we would not have been able to achieve all these milestones.



I would also take this opportunity to thank Dr. Atul Chauhan, President RBEF, and Dr. Aseem Chauhan, Addl. President RBEF and the entire AKC family who have been the pillar of strength and acted as a force multiplier for Amitians in their endeavor of making Amity the best in the world through research and innovation. The entire team of ASTIF and ADSI gratefully acknowledges the continuous guidance and blessings from all members of AKC Family.

My sincere appreciation and thanks to all the Vice-Chancellors, Pro Vice-Chancellors, for spearheading the mission and dream of Hon'ble Founder President in their respective campuses through praiseworthy leadership and untiring efforts towards constant monitoring, continuous motivation and sustained efforts which have led to achieving exponential growth. I would also like to appreciate the efforts put forth by all Deans, Heads of Institutions, Research coordinators, faculty members and researchers who are taking great strides towards strengthening the research and innovation initiatives. I would like to place on record my appreciation for the team effort of Dr. Smita Sahu, Dr. Goodwill Khokhar, Ms. Sneha Nair, Ms. Parul Singh, Dr. Vaibhav Singh Bhugra, Mr. Sanjai KV, Mr. Benny Thomas, Ms. Jiji Binu and Mr. Devendra Kumar for facilitating all Amitians in their research endeavors and preparing this report under the able guidance of Mr. S. N. Singh and bringing out the report in its present form.

Our Faculty members and Researchers were able to receive 75 Projects sanctioned during the year amounting to **Rs 30.35** Crores bringing the number of ongoing projects to **249** in the year 2021. In addition, **6046** Publications in journals of repute have been published. **218** Patents have been filed in the year, **129** Patents have been granted including **56** during 2021 itself. The achievements of 2021 deserve special appreciation as all Amity Universities have performed well even during unprecedented circumstances created in the country on account of wide lockdown due to COVID during 1st half of the year. I would like to compliment all achievers especially the ones who have worked towards fighting the pandemic through developing products and technologies.

ASTIF in consultation with all Universities has set a target of 8000+ Research Publications in Scopus and web of sciences indexed journals, 200 + funded research projects, 300+ patent filing, commercialization of at least 20+ technologies/ products developed by researchers for the year 2022.

My best wishes for success in all the future endeavors of Amity group.

Dr. W. Selvamurthy
President, ASTIF & Director General, ADSI

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Preamble

Amity Science, Technology & Innovation Foundation (ASTIF) is the umbrella body of the Amity Education Group for promoting and facilitating research and innovation in science, technology and innovation in all Amity Universities. It was founded by Dr. Ashok K. Chauhan, Hon'ble Founder President in the year 2008 with a vision of making Amity a Centre of Excellence in all Domains of Science & Technology at National and International level through an integrated research and academic endeavors to contribute to the National mission of India emerging as a Knowledge Superpower. Dr. W. Selvamurthy is now the President.

The primary objective is to create appropriate research ecosystem, enabling processes to nurture research culture and to undertake research in the frontier areas of Science & Technology leading to quality publications, patents, technology development and commercialization. To meet this objective, state of the Art research infrastructures have been created, both through National and International funds as well as through Amity resources to augment research. Centers of Excellence have been established in niche areas of Science & Technology. In addition, more than 17 research clusters in areas of great national and international importance are effectively functioning to act as force multiplier in Amity Group. ASTIF undertakes a wide spectrum of important activities, such as Talent search, providing Amity Research Fellowship for meritorious scholars, building collaborations, supporting accreditation, and ranking activities thereby creating an enabling ecosystem for research and innovation to blossom at Amity.

Further, Amity Directorate of Science & Innovation was created at Amity University Uttar Pradesh Noida and Amity Directorate of Research & Innovation in all campuses to achieve the mission of placing Amity amongst the topmost global Universities in the field of Science & Technology. The Directorate facilitates and supports faculty members for achieving the targets in terms of Projects, Patents, Publications, Product development, Collaboration etc.



**Founder President, Ritnand Balved Education Foundation
(The Foundation of Amity Institutions and the Sponsoring
Body of Amity Universities) & Chairman, ASTIF**



**Dr. W. Selvamurthy
President, ASTIF & Director General, ADSI**



**Prof. (Dr.) Ajit Varma
Vice President, ASTIF**



**Prof. (Dr.) B.C. Das
Vice President, ASTIF**



**Prof. (Dr.) S.L. Kothari
Vice President, ASTIF**



**Prof. (Dr.) V.K. Jain
Vice President, ASTIF**



**Lt. Gen. S.K. Gadeock
Vice President, ASTIF**



**Prof. M.S. Prasad
Vice President, ASTIF**

CHARTERS OF ASTIF & ADSI

Amity Science, Technology & Innovation Foundation (ASTIF): The various charters and activities of ASTIF are:

1. Develop appropriate research ecosystem for promotion of cutting-edge research in emerging fields of national and international importance.
2. Set targets for Projects, Patents, Publications, Technology Transfer, Consultancy, Extension, Ph.D. programme and enable the Amity group to achieve them.
3. IPR Protection: Filing of Patents and ensuring their grant through coordination and follow-up with the office of the Controller General of Patents. In addition, Copyrights are also registered.
4. Encourage Development of technologies and products leading to Commercialization through Transfer of Technology to the Industry.
5. Organize lectures/ oration from eminent scientists from India and abroad.
6. Conduct workshops and training programmes for writing quality Project proposals, Publications, IPR augmentation.
7. Offer financial support for selective scientific projects and offer fellowships to meritorious research scholars.
8. To identify and nurture scientific talents through research cluster formation, interaction meetings and providing synergy.
9. Dissemination of scientific achievements, research excellence and innovations to promote visibility of Amity Group through media.
10. Developing research policies/ concept notes relating to areas connected with promotion of quality research and innovation.
11. Development and updation of ASTIF Website and formulation S & T Brochures, promotional Film highlighting research accomplishments.
12. Facilitating National & International research Collaborations and promoting synergy of brains.
13. Identification and submission of quality applications/ proposals under various National/International Awards & Fellowship schemes.
14. Promoting Global Research Hub, initiatives in niche areas such as Global Research Network on Novel Viruses, Neurospine etc.
15. Conducting review meetings of all Amity Universities/Institutions in India & abroad to assess the Health and Performance management of the Organization.
16. Providing assistance to all AU Campuses addressing specific issues, if any, related to HR, Projects, Certifications like NGO Darpan registration etc.

Amity Directorate of Science & Innovation (ADSI) has also been established in 2014 to address all issues related to research and innovation at AUUP-Noida, Greater Noida, Lucknow & Dubai. 26 institutions under Science & Technology domain in AUUP have been brought under this Directorate for overseeing their performance. The main charters of this Directorate are:

1. To facilitate and catalyse research activities in AUUP and its constituent campuses.
2. Coordinate submission of quality research projects under various schemes from National and International funding agencies.
3. Set quantitative and qualitative targets in terms of research, publication & patents etc.
4. Periodic review and monitoring research endeavours including those of Ph.D. scholars.
5. Review and augment research facilities in the S&T Institutes as per the emerging needs.
6. Formulate Annual Research plan and monitor its progress in AUUP aligning to Broad Based Goals.
7. Motivate faculty members to attain their best in terms of competence, commitment, and self-motivation.
8. Promote transdisciplinary research with the participation of various relevant research Institutes.
9. Administrative & Financial Management of Funded Projects of AUUP.
10. Accreditation and rankings related activities of AUUP pertaining to Research, innovation, and extension activities.
11. To resolve any administrative or HR issues and address the grievance of Faculty and Scientists as and when referred to the Directorate.

GLIMPSE OF ACHIEVEMENTS 2021

Amity has created an appropriate Research eco-system through creation of World class infrastructure bench marked against best Universities around the World, State of the art Research facilities engaging quality Human Resource which have led to following achievements during the year 2021.

1. Awards and Achievement

- Indian Intellectual Property Office under the Department of Promotion of Industry and Internal Trade (DPIIT), Ministry of Commerce and Industry, Government of India has conferred Amity University as the winner of prestigious **National Intellectual Property Award for the year 2020 in the category of “Top Academic Institution for Patent and Commercialization”**
- Quetsel India has also conferred **IP Excellence Award 2021** to Amity University in recognition for valuable contribution as **an Innovation driven organization**
- 68 awards and 40 fellowships bestowed as the faculty members and researchers of Amity during the year 2021. 38 Amitians have been recognized for their outstanding research contributions. Some of the notable among them are Best Outstanding Academic Leader National Award, NASI Young Scientist Platinum Jubilee Award, Dare to Dream: 2.0 by DRDO, Royal Society of Biology, ICMR Shakuntala Amir Chand Award, NESAI Green Technology Innovative Award, Fellow of Royal Society of Chemistry, EMBO Fellowship, Conservation Leadership Award (UK University), DST (AWSAR), NASA India, NITI Aayog & Ministry of MSME (Govt. of India), SERB- Teacher Associateship for Research Excellence and many more.

2. Projects:

- A total of **75 sponsored Projects** have been sanctioned with a funding of Rs. 30.35 Crores.
- **The total number of ongoing projects is 249**

- A state of Art Nuclear Security Laboratory is being set up in collaboration with TEXAS A&M University, USA for education and professional development of Nuclear Science and Nuclear Security and Safety.

3. Publications:

- A total of **6046** Publication have been done out of which 3425 are Scopus indexed.
- **239** Publications have an **Impact Factor** ranging from **6 to 79**.
- **h-index** of the University is **98**
- **Fifteen** Amity University faculty members figure in **top 2%** of Global Researchers from India, in the list compiled by Stanford University, USA.
- Dr. Durgesh Kumar Tripathi from Amity Institute of Organic Agriculture, Amity University Uttar Pradesh has been recognised as one of the “**Highly Cited Researcher 2021**” by Clarivate Anlytics. Dr. Durgesh is among the 22 Indians who has been recognised in this list of **top 1%** Scientists in the world.

4. Patents/Copyrights:

- A total of 1625 patents have been filed out of which 218 were filed during 2021 itself.
- A total of 129 patents have been granted out of which 56 were granted during 2021
- 73 copyrights have been filed out of which 25 have been registered

5. Technologies Transferred:

- 8 Technologies have been transferred to Industries for commercialization during the year.

6. Research enrichment initiatives

- The research endeavors have been strengthened further through 46 research centers and 20 Centres of Excellence in niche areas established across Amity Universe.
- A total of 7 New Research clusters in addition to existing 10, have been initiated in areas of National and International

importance for bringing out synergy of ideas and thoughts for enhancing research productivity.

- 120 MoUs (62 National & 58 International) were signed during the year.
- 29 Ramalingaswami re-entry, Ramanujan, DST-INSPIRE, SERB-SRS, Wellcome Trust Fellows are presently working at Amity.
- 7 Honorary Doctorates were awarded to eminent personalities while 28 eminent persons from across the globe were bestowed with Honorary Professorship.
- Global Research Network on Novel Viruses, Amity Global Research Hub at USA, ASTIF German chapter, Amity Global Research Network on Neuro-spine has been established for providing impetus to research and innovation endeavors of the group.

7. Faculty enrichment initiatives

- The group has organized more than 1350 Webinars of global relevance during the year during the lockdown period for keeping its faculty members and researchers updated with recent technological advancement in their field of research.
- In addition to this, 159 Conferences, Seminars and workshops as well as 125 FDPs were organized using online mode.
- Amitians have also contributed towards "FIGHTING CORONAVIRUS" through developing a clever assay for COVID Diagnosis, CRISPER/ CAS System for diagnosis as well as therapeutics for COVID-19, COVID -19 Kit etc.

Chapter – 1

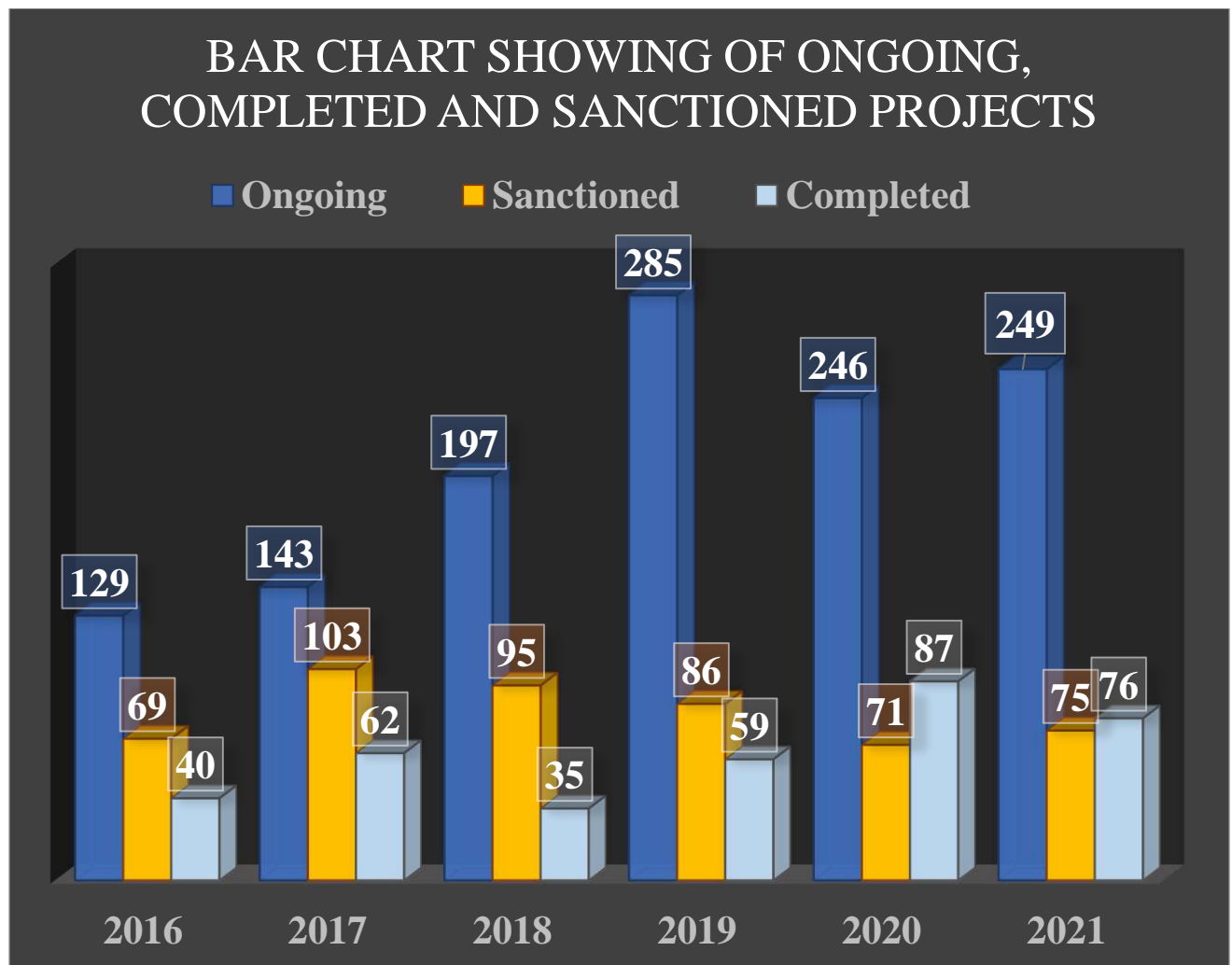
PROJECTS

• FUNDED PROJECTS

- 1.1. Amity University, being conscious of the fact that sponsored research projects play a pivotal role in building a strong research culture amongst the scientists and researchers, lays great emphasis on such funded research projects awarded by National and International organizations for generation and dissemination and application of knowledge for the benefit of the society.
- 1.2. Amity Foundation for Science, Technology & Innovation Alliances (AFSTIA), Amity Centre for Developmental Cooperation and Alliances (I & II) have been set up exclusively to accelerate the number of submissions of quality proposals through timely identifying funding opportunities and submission of quality proposals by the relevant faculty members; and monitoring formulation of quality research proposals as well as their technical implementation after approval.
- 1.3. Amity Directorate of Science & Innovation (ADSI) facilitates Administrative & Financial Management of sanctioned research projects through an in-house developed software on “Research Project Management System”.
- 1.4. **Despite the impact of Coronavirus pandemic and financial restrictions, Amity Universities have been able to submit more than 400 project proposals against various schemes announced by National and International funding agencies and have achieved the distinction of getting 75 projects sanctioned during the year amounting to Rs. 30.35 Crores.**

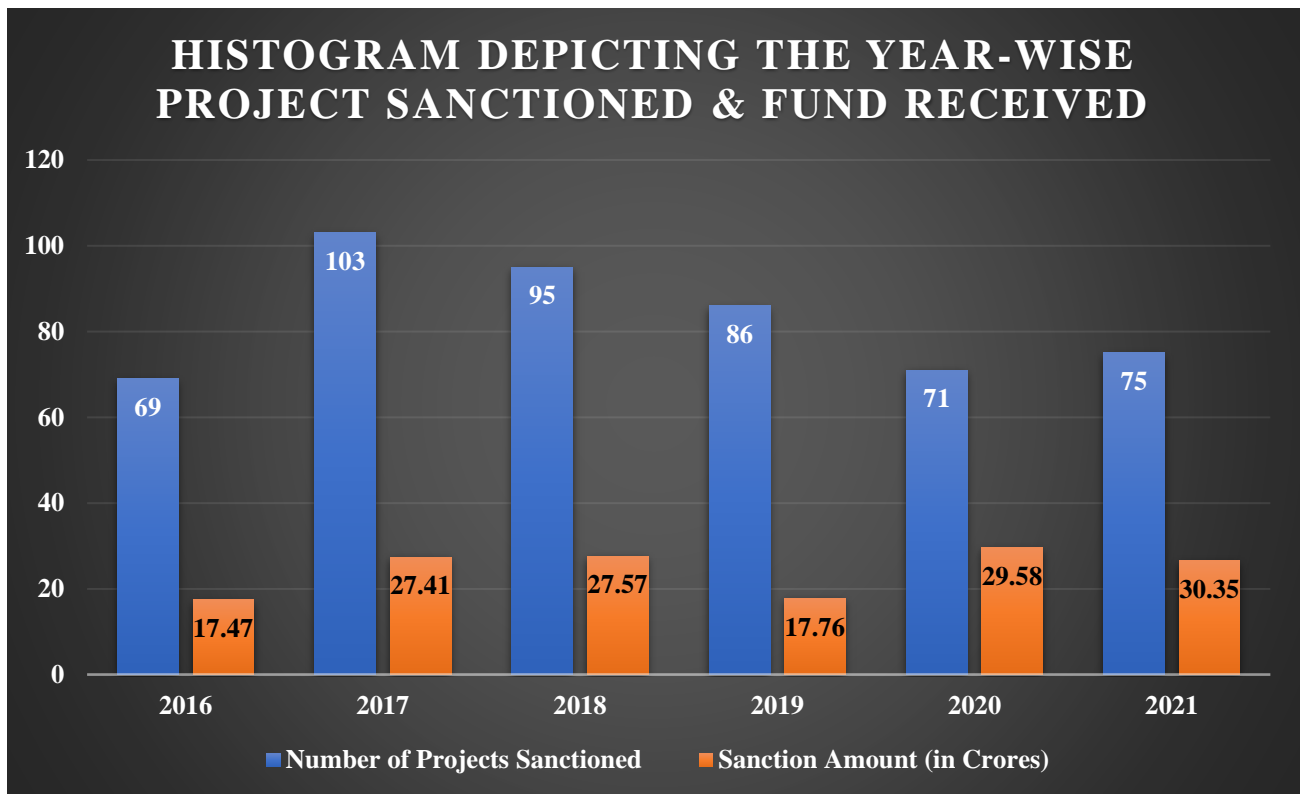
1.5. The summary of sanctioned, ongoing and completed research projects funded by National & International funding agencies during the year 2021 is as given below:-

Comparative Figures of all Amity campuses					
Year	2017	2018	2019	2020	2021
Total No. of Projects ongoing	143	197	285	246	249
Total No. of projects sanctioned	103	95	86	71	75
Total No. of projects completed	62	35	59	87	76





1.6 Funds received for Sanctioned/ Approved projects

	2017	2018	2019	2020	2021
Total No. of projects sanctioned/approved	103	95	86	71	75
Amount in Rupees (Crores)	27.41	27.57	17.76	29.58	30.35



1.7 The faculty members and researchers from across Amity Universe have made dedicated efforts for finding solutions towards supporting the Nation in the “**FIGHT AGAINST COVID**”. Following two projects have been sanctioned under the same :





Sr. No.	Name of Institution	Project Details	Sanctioned Amount	Principal Investigator
1	AIB, AUK	Project Title: Predicting future SARS-CoV2 spike RBD variants with pandemic potential Funding Agency: The COVID-19 High Performance Computing (HPC) Consortium (Private-public initiative of White House Office of Science and Technology Policy, the U.S. Department of Energy and IBM)	INR 1,03,00,000	 Dr. Sandipan Chakraborty
2	ASE, AUUP	Project Title: Analysing the Factors Determining Health Seeking Behaviour of Street Vendors and Influence of Nudge during Present Pandemic Funding Agency: Indian Council of Social Science Research	INR 3,75,000	 Dr Kavita Indapurkar
Total Amount (INR)			1,06,75,000	

1.8 The funds received by the University for undertaking Consultancy, Training and Skill Development programme for the year 2021 are as follows:-

Type of Project/ Training	Funds Sanctioned in INR
Sanctioned Projects	30,35,95,960
Consultancy and Training	5,47,30,000
Total	35,83,25,960

GLIMPSE OF HIGH VALUE RESEARCH PROJECTS





SANCTIONED IN - 2021

S. No.	Project Details	Principal Investigator
1	<p>Project Title: Amity University-DTRA Technical Assistance Program for Amity University</p> <p>Funding Agency: DTRA & Texas A&M University, USA</p> <p>Sanctioned Amount: INR 8,15,87,960</p> <p>Sanctioned Date: 08-07-2020</p> <p>Duration: 2 Years</p>	 Dr Alpina Goel, AINST, AUUP
2	<p>Project Title: DBT Skill Vigyan Programme under state partnership in Life Science and Biotechnology</p> <p>Funding Agency: Department of Biotechnology (DBT)</p> <p>Sanctioned Amount: INR 12300000</p> <p>Sanctioned Date: 08-01-2021</p> <p>Duration: 5 Years</p>	 Dr. Rajendra Prasad, AIB, AUH
3	<p>Project Title: DST FIST Programme</p> <p>Funding Agency: Department of Science & Technology (DST)</p> <p>Sanctioned Amount: INR 21600000</p> <p>Sanctioned Date: 31/03/2021</p> <p>Duration: 5 Years</p>	 Dr Deepshikha Pande Katare, AIB, AUUP
4	<p>Project Title: An integrated biorefinery approach for production of sustainable biofuel and bioproducts from microalgae combined with wastewater treatment and flue gas CO₂ fixation</p> <p>Funding Agency: Department of Biotechnology (DBT)</p> <p>Sanctioned Amount: INR 11360000</p> <p>Sanctioned Date: 23/02/2021</p> <p>Duration: 5 Years</p>	 Dr. Manoranjan Nayak, Ramagingaswami Fellow, AIB, AUUP









5	<p>Project Title: Predicting future SARS-CoV2 spike RBD variants with pandemic potential Funding Agency: The COVID-19 High Performance Computing (HPC) Consortium (Private-public initiative of White House Office of Science and Technology Policy, the U.S. Department of Energy and IBM) Sanctioned Amount: INR 10300000 Sanctioned Date: 23-09-2021 Duration: 6 Months</p>	 <p>Dr. Sandipan Chakraborty, AIB, AUK</p>
6	<p>Project Title: Establishing the relationship of p53 mutations and amyloid formation: A new insight in Cancer biology and therapeutics Funding Agency: Department of Biotechnology (DBT) Sanctioned Amount: INR 8447903 Sanctioned Date: 15-11-2021 Duration: 5 Years</p>	 <p>Dr. Shinjee Dasgupta, AIMMSCR, AUUP</p>
7	<p>Project Title: Technical Assistance to Mission Directorate JJM, PHED Chhattisgarh on strengthening monitoring capacities on JJM in 14 districts of Chhattisgarh, Funded by UNICEF Funding Agency: UNICEF Sanctioned Amount: INR 7721000 Sanctioned Date: 01-06-2021 Duration: 1.2 Years</p>	 <p>Prof. Surendra N. Rahamatkar, Director, ASET and assisted by Prof. Satyendra Patnaik, Head-CRC, ASET, AUC</p>
8	<p>Project Title: Elucidating the role of post-transcriptional regulation of sphingolipid metabolic genes in breast cancer progression. Funding Agency: Science and Engineering Research Board (SERB) Sanctioned Amount: INR 6980724 Sanctioned Date: 01-12-2021 Duration: 3 YEARS</p>	 <p>Dr. Ujjaini Das Gupta, AIB, AUH</p>



9	<p>Project Title: Development of a table-top equipment for measurement of the lifetime and diffusion length of minority carriers in silicon solar cells</p> <p>Funding Agency: Department of Science & Technology (DST)</p> <p>Sanctioned Amount: INR 6193360</p> <p>Sanctioned Date: 03-06-2021</p> <p>Duration: 3 Years</p>	 <p>Dr V. K. Jain, AIARS(M&D), AUUP</p>
10	<p>Project Title: Circular urban cultivation systems with re-useable textile growing substrates</p> <p>Funding Agency: Department of Science & Technology (DST)</p> <p>Sanctioned Amount: INR 6009640</p> <p>Sanctioned Date: March 19, 2021</p> <p>Duration: 3years</p>	 <p>Total 6 PI:Dr. Harshata Pal, AIB, AUK</p>
11	<p>Project Title: Regulation of ribosome biogenesis and SOS response by cyclic di-AMP in Mycobacterium</p> <p>Funding Agency: Science and Engineering Research Board (SERB)</p> <p>Sanctioned Amount: INR 5786000</p> <p>Sanctioned Date: 26-03-2021</p> <p>Duration: 3 Years</p>	 <p>Dr. Krishna Murari Sinha (PI), Dr Aneesh Kumar NII (CO-PI), AIB, AUH</p>
12	<p>Project Title: Identification of therapeutics targeting novel druggable allosteric sites of SARS-CoV-2 Polymerase-Exonuclease multi-protein complex using drug</p> <p>Funding Agency: Microsoft Inc.</p> <p>Sanctioned Amount: INR 5500000</p> <p>Sanctioned Date: 25.02.2021</p> <p>Duration: 3 years</p>	 <p>Dr. Sandipan Chakraborty (Assistant Professor, Grade II), AIB, AUK</p>



13	<p>Project Title: Insights into the efflux pump arsenal of the emerging pathogen <i>C. auris</i> and its implication in high order of antifungal resistance and virulence</p> <p>Funding Agency: Department of Biotechnology (DBT)</p> <p>Sanctioned Amount: INR 5489236</p> <p>Sanctioned Date: Feb 17 2021</p> <p>Duration: 3 Years</p>	 Prof. Rajendra Prasad,  Dr. Atanu Banerjee, AIB, AUH
14	<p>Project Title: Molecular Insights into Ligand-selective and Cholesterol-specific Activation of the GPCR Serotonin1A Receptor with GPU-enabled High-performance Computing</p> <p>Funding Agency: Science and Engineering Research Board (SERB)</p> <p>Sanctioned Amount: INR 4820000</p> <p>Sanctioned Date: 10.12.2021</p> <p>Duration: 3 Years</p>	 PI: Dr. Sandipan Chakraborty; Co-PI: Prof. Amitabha Chattopadhyay, AUK
15	<p>Project Title: A crosstalk between DNA replication and chromosome segregation</p> <p>Funding Agency: Science and Engineering Research Board (SERB)</p> <p>Sanctioned Amount: INR 4799672</p> <p>Sanctioned Date: 14-01-2021</p> <p>Duration: 3 Years</p>	 Dr. Soumitra Sau, AIB, AUK
16	<p>Project Title: Design and development of Nano-scaffolds for bone tissue regeneration</p> <p>Funding Agency: Indian Council of Medical Research (ICMR)</p> <p>Sanctioned Amount: INR 4725500</p> <p>Sanctioned Date: 26-11-2021</p> <p>Duration: 3 Years</p>	 Dr Shaheen Husain, AINT, AUUP
17	<p>Project Title: Base Metal Catalyzed Heterogeneous Direct Arylation Reactions</p> <p>Funding Agency: Science and Engineering Research Board (SERB)</p> <p>Sanctioned Amount: INR 4600000</p> <p>Sanctioned Date: 01-04-2021</p> <p>Duration: 2 Years</p>	 Dr Kayambu Namitharam, AICCRS, AUUP

FELLOWS ENROLLED IN 2021 UNDER PROJECTS

A total of 40 Fellows under various projects and fellowships have been enrolled in Amity Universe during the year as per the following details:

S.No	Fellowship	No
1	SERB-TARE	3
2	CSIR JRF	2
3	CSIR SRF	1
4	UGC-JRF	30
5	DST Wos-B	1
6	ICMR SRF	3
Total		40

RAMALINGASWAMI, RAMANUJAN & DST-INSPIRE FELLOWS 2021

A number of researchers who have been awarded prestigious fellowships such as Ramalingaswami re-entry fellowship, Ramanujan fellowship, DST-INSPIRE etc have been associated with amity in the past few years. The total number of such fellows working in Amity university campuses is as mentioned below:-

Type of Fellowship	Total
Ramalingaswami Fellow	20
DST Inspire Faculty Fellow	6
Ramanujan Fellow	1
SERB SRS Fellow	1
Wellcome Trust Fellow	1
Total	29

Chapter – 2

PUBLICATIONS

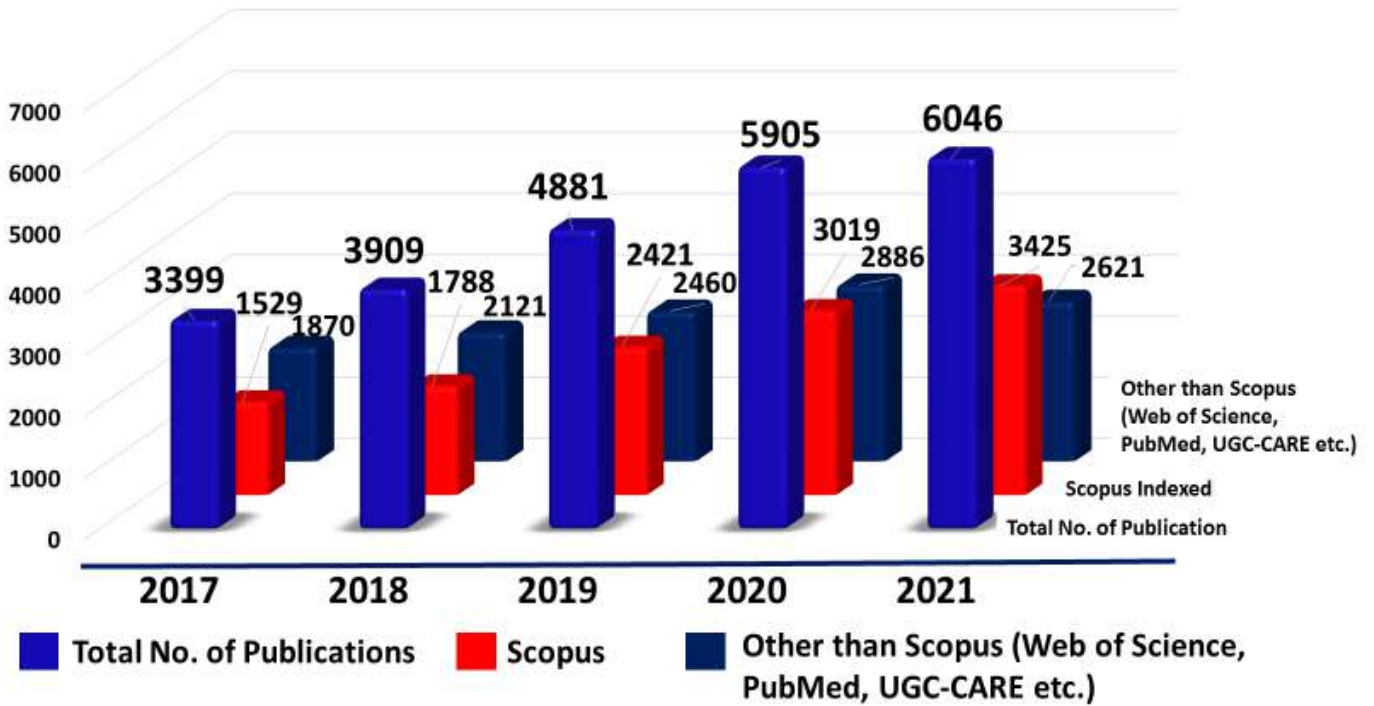
2.1 Publication, a mirror image of knowledge generation based on research and its dissemination for societal benefit has been at the core of scientists and researchers of Amity Universities who pursue research activities tirelessly, and publish their work in reputed, peer-reviewed refereed journals indexed in Scopus and web of sciences.

2.2 Our aim is to strengthen research and enhance the publications both qualitatively and quantitatively and contribute in strengthening the National position.

2.3 This year a total of 6046 publications have been made, out of which over 239 are having an impact factor ranging from 6.0 to 79.321.

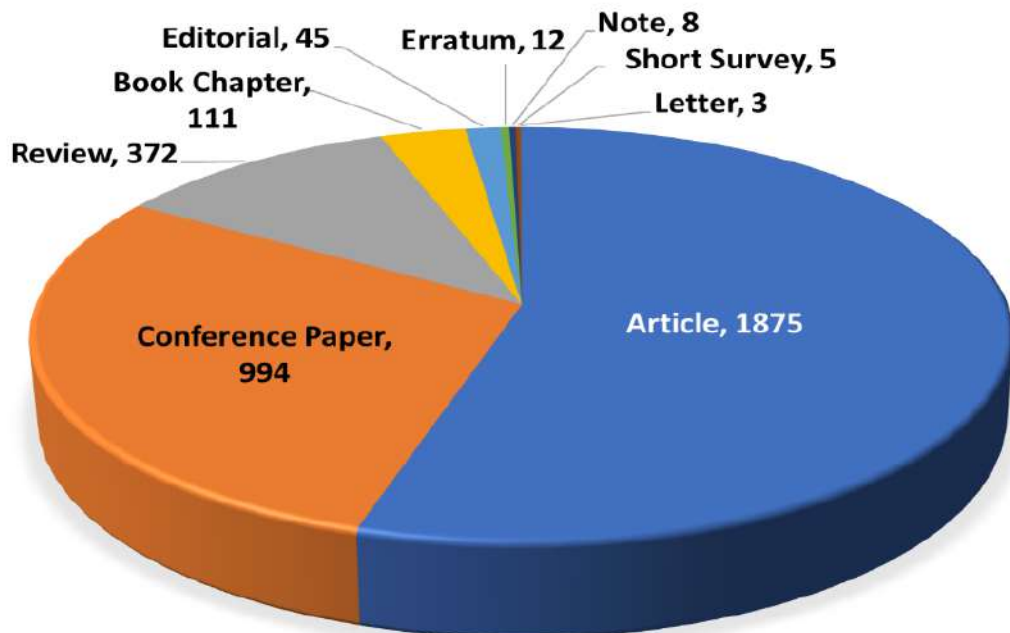
2.4 A Glimpse of data shared herein gives the summary of the number of Research Papers/ Books/ Book Chapters/ Papers in conference proceedings indicating the growth pattern in the Publication domain.

Year	2017	2018	2019	2020	2021
Total No. of Publication	3399	3909	4881	5905	6046
Scopus Indexed	1529	1788	2421	3019	3425
Other than Scopus (Web of Science, PubMed, UGC CARE etc.)	1870	2121	2460	2886	2621



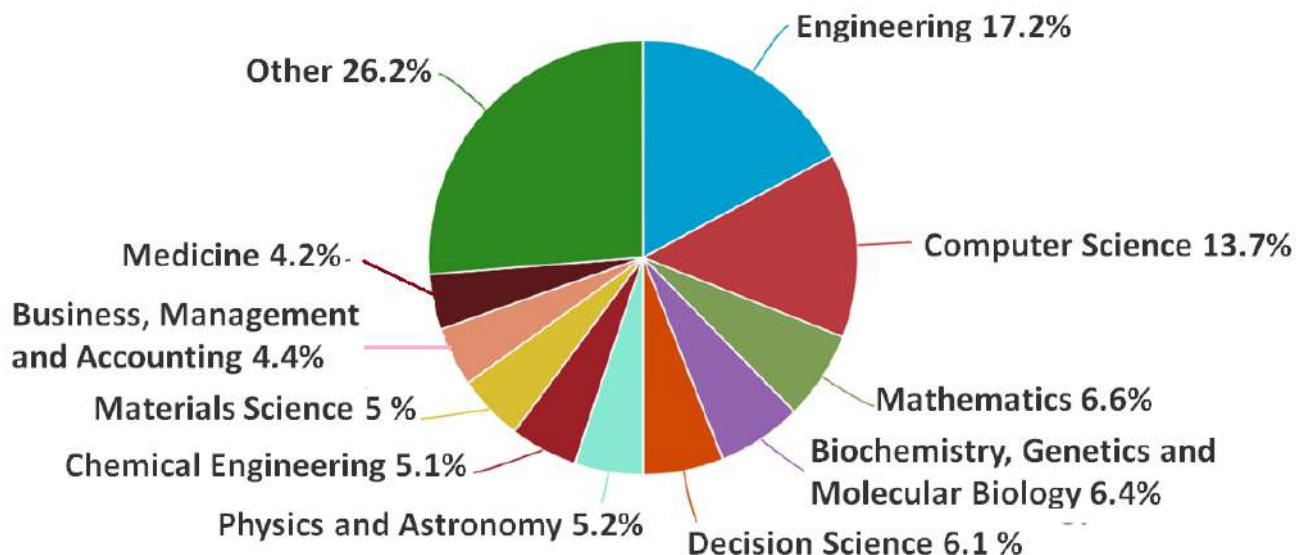
2.5 Analysis of Scopus indexed Publications for the year 2021

- The percentage of the publications document wise such as Articles, Conference papers etc. is given below:





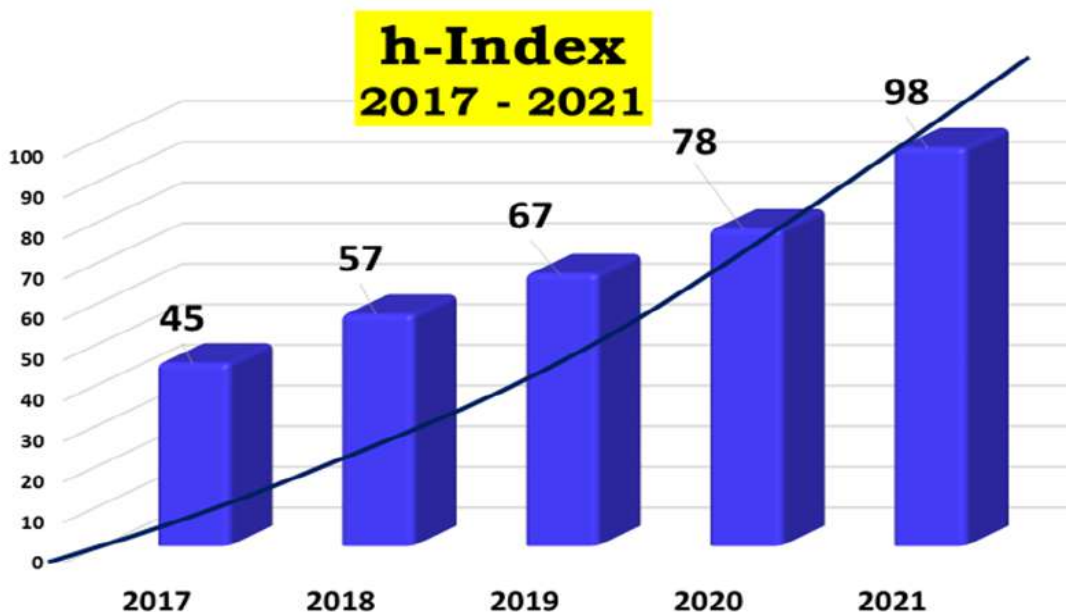
- The percentage of publications based on their subject is as given below:



* Other 26.2% (Chemistry, Agricultural and Biological Sciences, Environmental Science, Pharmacology, Toxicology and Pharmaceuticals, Energy, Social Sciences, Immunology and Microbiology, Economics, Econometrics and Finance, Earth and Planetary Sciences, Multidisciplinary, Health Professions, Neuroscience, Psychology, Arts and Humanities, Nursing, Veterinary, Dentistry)

- h-index of Amity University for the last 5 years:

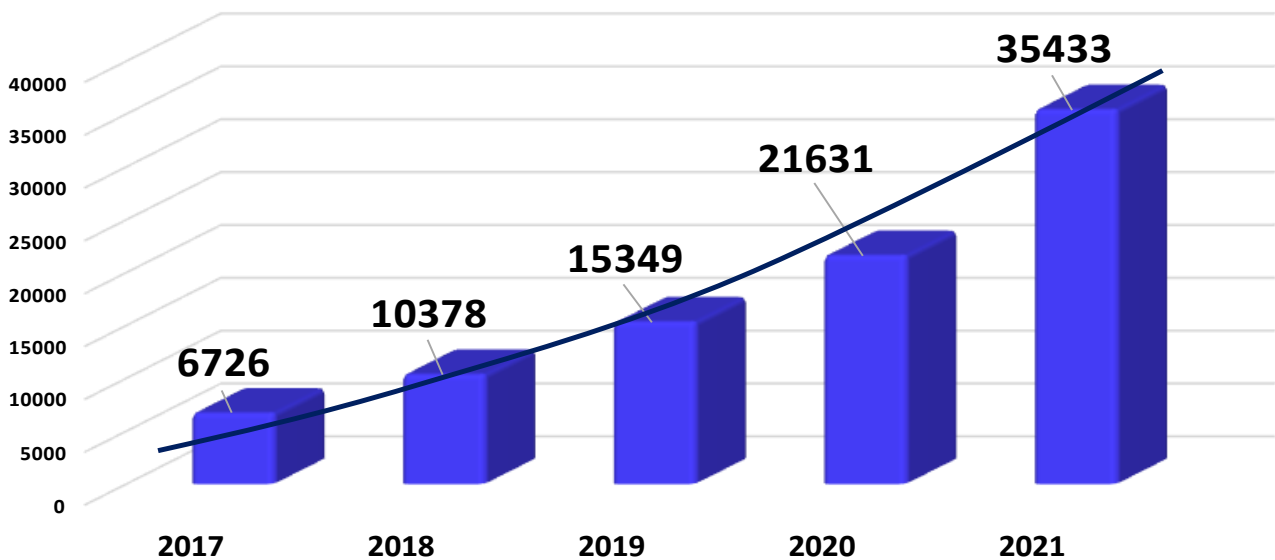
Year	2017	2018	2019	2020	2021
h-index	45	57	67	78	98








2.6 The citations of research publications by Amity faculty members/researchers as per Scopus for the last 4 years is depicted below:-





Year	2017	2018	2019	2020	2021
Citations	6726	10378	15349	21631	35433

Citations 2017 - 2021








**A GLIMPSE OF STAR PUBLISHERS
 (BASED ON IMPACT FACTOR MORE THAN 10)**





S. No.	Publication	Photograph
1	<p>Title of Paper: Global, regional, and national progress towards Sustainable Development Goal 3.2 for neonatal and child health: all-cause and cause-specific mortality findings from the Global Burden of Disease Study 2019</p> <p>Name of Journal: The Lancet</p> <p>Impact Factor: 79.321</p> <p>Name of Author: Era Upadhyay</p> <p>Name of Department/University/Campus: AIB, AU, Rajasthan</p>	 Dr. Era Upadhyay, AIB, AUR
2	<p>Title of Paper: Measuring routine childhood vaccination coverage in 204 countries and territories, 1980–2019: a systematic analysis for the Global Burden of Disease Study 2020, Release 1</p> <p>Name of Journal: The Lancet</p> <p>Impact Factor: 79.321</p> <p>Name of Author: H Khajuria, B P Nayak</p> <p>Name of Department/University/Campus: AIFS, AUUP, Noida</p>	 Dr. Himanshu Khajuria,  Dr. Biswa P. Nayak AIFS, AUUP
3	<p>Title of Paper: Tracking development assistance for health and for COVID-19: a review of development assistance, government, out-of-pocket, and other private spending on health for 204 countries and territories, 1990–2050</p> <p>Name of Journal: The Lancet</p> <p>Impact Factor: 79.321</p> <p>Name of Author: H Khajuria, B P Nayak</p> <p>Name of Department/University/Campus: AIFS, AUUP, Noida</p>	 Dr. Himanshu Khajuria,  Dr. Biswa P. Nayak AIFS, AUUP

4	<p>Title of Paper: Anemia prevalence in women of reproductive age in low- and middle-income countries between 2000 and 2018</p> <p>Name of Journal: Nature Medicine</p> <p>Impact Factor: 53.44</p> <p>Name of Author: Era Upadhyay</p> <p>Name of Department/University/Campus: AIB, AU, Rajasthan</p>	 Dr. Era Upadhyay, AIB, AUR
5	<p>Title of Paper: Mapping routine measles vaccination in low- and middle-income countries</p> <p>Name of Journal: Nature</p> <p>Impact Factor: 42.778</p> <p>Name of Author: Era Upadhyay</p> <p>Name of Department/University/Campus: AIB, AU, Rajasthan</p>	 Dr. Era Upadhyay, AIB, AUR
6	<p>Title of Paper: Cancer Incidence, Mortality, Years of Life Lost, Years Lived with Disability, and Disability-Adjusted Life Years for 29 Cancer Groups from 2010 to 2019: A Systematic Analysis for the Global Burden of Disease Study 2019</p> <p>Name of Journal: JAMA Oncology</p> <p>Impact Factor: 31.78</p> <p>Name of Author: Era Upadhaya</p> <p>Name of Department/University/Campus: AIB, AU, Rajasthan</p>	 Dr. Era Upadhyay, AIB, AUR
7	<p>Title of Paper: Borophene via Micromechanical Exfoliation</p> <p>Name of Journal: Advanced Materials</p> <p>Impact Factor: 30.849</p> <p>Name of Author: Dattatreya J. Late</p> <p>Name of Department/University/Campus: ACNN, AU, Mumbai</p>	 Dr. Dattatray J. Late, ASET, AUM







8	<p>Title of Paper: Exposure to endocrine-disrupting chemicals in utero and thyroid cancer risk in offspring Name of Journal: The Lancet Diabetes and Endocrinology Impact Factor: 25.340 Name of Author: Das A.M., Das B.C. Name of Department/University/Campus: AIPH, AIMMSCR, AUUP, Noida</p>	 Prof. (Dr.) B. C. Das, AIMMSCR, AUUP
9	<p>Title of Paper: Preformed molecular complexes of metals with organoselenium ligands: Syntheses and applications in catalysis Name of Journal: Coordination Chemistry Reviews Impact Factor: 22.315 Name of Author: Gyandshwar K. Rao Name of Department/University/Campus: ASAS, AU, Haryana</p>	 Dr. Gyandshwar K. Rao, ASAS, AUH
10	<p>Title of Paper: DNA damage in brain may lead to cognitive dysfunctions and reduced longevity in WNIN/Ob obese rats Name of Journal: Alzheimer's & Dementia Impact Factor: 21.566 Name of Author: Jitendra Kumar Sinha Name of Department/University/Campus: AINN, AUUP, Noida</p>	 Dr. Jitendra Kumar Sinha, AINN, AUUP
11	<p>Title of Paper: Age-associated insolubility of parkin in human midbrain is linked to redox balance and sequestration of reactive dopamine metabolites Name of Journal: Acta Neuropathologica Impact Factor: 17.088 Name of Author: Rajib Sengupta Name of Department/University/Campus: AIB, AU, Kolkata</p>	 Dr. Rajib Sengupta, AIB, AUK
12	<p>Title of Paper: OlfactionBase: a repository to explore odors, odorants, olfactory receptors and odorant-receptor interactions Name of Journal: Nucleic Acids Research Impact Factor: 16.971 Name of Author: Rajnish Kumar Name of Department/University/Campus: AIB, AUUP, Lucknow</p>	 Rajnish Kumar, AIB, AUUP, Lucknow







13	<p>Title of Paper: Phosphorylation of a reinitiation supporting protein, RISP, determines its function in translation reinitiation</p> <p>Name of Journal: Nucleic Acids Research</p> <p>Impact Factor: 16.971</p> <p>Name of Author: Jamsheer M.</p> <p>Name of Department/University/Campus: AIGE, AUUP, Noida</p>	 <p>Dr. Muhammed Jamsheer K, AIGE, AUUP</p>
14	<p>Title of Paper: Bacteria as a treasure house of secondary metabolites with anticancer potential</p> <p>Name of Journal: Seminars in Cancer Biology</p> <p>Impact Factor: 15.707</p> <p>Name of Author: Garg, M.</p> <p>Name of Department/University/Campus: AIMMSCR, AUUP, Noida</p>	 <p>Dr. Manoj Garg, AIMMSCR, AUUP</p>
15	<p>Title of Paper: A comprehensive review of the multifaceted role of the microbiota in human pancreatic carcinoma</p> <p>Name of Journal: Seminars in Cancer Biology</p> <p>Impact Factor: 15.707</p> <p>Name of Author: Pandya G., Kirtonia A., Singh A., Pandey A.K., Kapoor S., Tandon S., Sethi G., Garg M.</p> <p>Name of Department/University/Campus: AIMMSCR Noida & AIB Haryana</p>	 <p>Dr. Manoj Garg, AIMMSCR, AUUP</p>
16	<p>Title of Paper: Insights into the role of complement regulatory proteins in HPV mediated cervical carcinogenesis</p> <p>Name of Journal: Seminars in Cancer Biology</p> <p>Impact Factor: 15.707</p> <p>Name of Author: Khan A., Das B.C., Abiha U., Das A.M., Rashid S.</p> <p>Name of Department/University/Campus: AIB, AIMMSCR, AIPH, AUUP, Noida</p>	 <p>Dr. Shazia Rashid, AIB, AUUP</p>







17	<p>Title of Paper: Specific targeting cancer cells with nanoparticles and drug delivery in cancer therapy Name of Journal: Seminars in Cancer Biology Impact Factor: 15.707 Name of Author: Raj S., Khurana S., Das B.C., Kumar D. Name of Department/University/Campus: AIMMSCR, AIB AUUP, Noida</p>	 Dr. Dhruv Kumar AIMMSCR, AUUP
18	<p>Title of Paper: Role of Epigenetics in carcinogenesis: Recent Advancements in Anticancer Therapy Name of Journal: Seminars in Cancer Biology Impact Factor: 15.707 Name of Author: Abiha U Name of Department/University/Campus: AIB, AUUP, Noida</p>	 Umme Abiha AIB, Noida
19	<p>Title of Paper: Targeting cancer cells with nanotherapeutics and nanodiagnostics: Current status and future perspectives Name of Journal: Seminars in Cancer Biology Impact Factor: 15.707 Name of Author: Tripathi, Swati Name of Department/University/Campus: AIMT AUUP, Noida</p>	 Dr. Swati Tripathi, AIMT AUUP
20	<p>Title of Paper: Repurposing of drugs: An attractive pharmacological strategy for cancer therapeutics Name of Journal: Seminars in Cancer Biology Impact Factor: 15.707 Name of Author: Kirtonia A., Pandya G., Pandey A.K., Garg M. Name of Department/University/Campus: AIMMSCR NOIDA & AIB HARYANA</p>	 Dr. Manoj Garg, AIMMSCR, AUUP








21	<p>Title of Paper: Bile Acid Tethered Docetaxel-Based Nanomicelles Mitigate Tumor Progression through Epigenetic Changes Name of Journal: Angewandte Chemie - International Edition Impact Factor: 15.336 Name of Author: Sharma H., Sharma R.D., Dasgupta U. Name of Department/University/Campus: AIISH, AU, Haryana</p>	 <p>Dr. Ravi Datta Sharma</p>  <p>Dr. Ujjaini Dasgupta, AIB & AIISH, AUH</p>
22	<p>Title of Paper: State of biofuel development in sub-Saharan Africa: How far sustainable? Name of Journal: Renewable and Sustainable Energy Reviews Impact Factor: 14.982 Name of Author: Jha, P. Name of Department/University/Campus: AIB, AU, Kolkata</p>	 <p>Dr. Priyanka Jha AIB, AUK</p>
23	<p>Title of Paper: Single Mn Atom Doping in Chiral Sensitive Assembled Gold Clusters to Molecular Magnet Name of Journal: ACS Nano Impact Factor: 14.588 Name of Author: Dr. Pooja Srivastava Name of Department/University/Campus: ASAS, AUUP, Lucknow</p>	 <p>Dr. Pooja Srivastava ASAS, AUUP, Lucknow</p>








24	<p>Title of Paper: Transcription Factors as Zinc Sensors in Plants Name of Journal: Trends in Plant Science Impact Factor: 14.416 Name of Author: Jamsheer K M., Kumar M. Name of Department/University/Campus: AFAF, AUUP, Noida</p>	 <p>Dr. Muhammed Jamsheer K,</p>  <p>Dr. Manoj Kumar, AIGE, AUUP</p>
25	<p>Title of Paper: Silica nanoparticles: the rising star in plant disease protection Name of Journal: Trends in Plant Science Impact Factor: 14.416 Name of Author: Kandhol, N., Tripathi, D.K. Name of Department/University/Campus: AIOA, AUUP, Noida</p>	 <p>Dr. D. K. Tripathi, AIOA, AUUP</p>
26	<p>Title of Paper: Green software: Refactoring approach Name of Journal: Journal of King Saud University - Computer and Information Sciences Impact Factor: 13.473 Name of Author: Sehgal R., Mehrotra D., Nagpal R., Sharma R. Name of Department/University/Campus: ASET, AUUP, Noida</p>	 <p>Dr. Rajni Sehgal ASET, AUUP</p>








27	<p>Title of Paper: Color image encryption system using combination of robust chaos and chaotic order fractional Hartley transformation</p> <p>Name of Journal: Journal of King Saud University - Computer and Information Sciences</p> <p>Impact Factor: 13.473</p> <p>Name of Author: Agarwal R.</p> <p>Name of Department/University/Campus: ASET, AUUP</p>	 <p>Dr. Rekha Agarwal, ASET, AUUP</p>
28	<p>Title of Paper: A dynamic window-size based segmentation technique to detect driver entry and exit from a car</p> <p>Name of Journal: Journal of King Saud University - Computer and Information Sciences</p> <p>Impact Factor: 13.473</p> <p>Name of Author: Amit Hirawat, Swapnesh Taterh</p> <p>Name of Department/University/Campus: AIIT, Amity University Rajasthan</p>	 <p>Mr. Amit Hirawat</p>  <p>Dr. Swapnesh Taterh AIIT, AUR</p>
29	<p>Title of Paper: Fabrication of heterostructure composites of Ni-Zn-Cu-Ferrite-C₃N₄-Poly(vinylidene fluoride) films for the enhancement of electromagnetic interference shielding effectiveness</p> <p>Name of Journal: Chemical Engineering Journal</p> <p>Impact Factor: 13.273</p> <p>Name of Author: Chakraborty T., Sharma S., Debnath T., Selvam A., Chakrabarti S., Sutradhar S.</p> <p>Name of Department/University/Campus: AIAS Kolkata & AINT Noida</p>	 <p>Dr. Soumyaditya Sutradhar, AIAS, AUK</p>  <p>Dr. Sandip Chakrabarti AINT, AUUP</p>







30	<p>Title of Paper: Experiments and DFT computations combine to decipher Fe-catalyzed amidine synthesis through nitrene transfer and nitrile insertion Name of Journal: ACS Catalysis Impact Factor: 13.08 Name of Author: Patra, R. Name of Department/University/Campus: AICCRS, AUUP, Noida</p>	 Dr. Ranjan Patra, AICCRS, AUUP
31	<p>Title of Paper: The pleiotropic role of transcription factor STAT3 in oncogenesis and its targeting through natural products for cancer prevention and therapy Name of Journal: Medicinal Research Reviews Impact factor: 12.944 Name of Author: Garg M., Bhardwaj V., Gupta R., Sharma A., Baligar P Name of Department/University/Campus: AIMMSCR AUUP, Noida</p>	 Dr. Manoj Garg, AIMMSCR, AUUP
32	<p>Title of Paper: Global, regional, and national sex-specific burden and control of the HIV epidemic, 1990–2019, for 204 countries and territories: the Global Burden of Diseases Study 2019 Name of Journal: The Lancet HIV Impact Factor: 12.767 Name of Author: H Khajuria, B P Nayak Name of Department/University/Campus: AIFS, AUUP, Noida</p>	 Dr. Himanshu Khajuria,  Dr. Biswa P. Nayak AIFS, AUUP
33	<p>Title of Paper: Recent progress in the development of biomass-derived nitrogen-doped porous carbon Name of Journal: Journal of Materials Chemistry A Impact Factor: 12.732 Name of Author: Dr Saikat Dutta Name of Department/University/Campus: AICCRS, AUUP, Noida</p>	 Dr. Saikat Dutta, AICCRS, AUUP






34	<p>Title of Paper: Nanoparticles as fingerprint sensors Name of Journal: TrAC - Trends in Analytical Chemistry Impact Factor: 12.296 Name of Author: Kumari, A. Name of Department/University/Campus: AIFS, AUUP, Noida</p>	 Dr. Amrita Kumari Das AIFS, AUUP
35	<p>Title of Paper: Mapping inequalities in exclusive breastfeeding in low- and middle-income countries, 2000–2018 Name of Journal: Nature Human Behaviour Impact Factor: 12.282 Name of Author: Era Upadhyay Name of Department/University/Campus: AIB, AU, Rajasthan</p>	 Dr. Era Upadhyay, AIB, AUR
36	<p>Title of Paper: Suppression of monosodium urate crystal-induced inflammation by inhibiting TGF-β-activated kinase 1-dependent signaling: role of the ubiquitin proteasome system Name of Journal: Cellular and Molecular Immunology Impact Factor: 11.530 Name of Author: Chourasia M. Name of Department/University/Campus: AIB AUUP, Noida</p>	 Dr. M. Chourasia AIB, AUUP
37	<p>Title of Paper: Doping Independent Work Function and Stable Band Gap of Spinel Ferrites with Tunable Plasmonic and Magnetic Properties Name of Journal: Nano Letters Impact Factor: 11.19 Name of Author: Shilpa Taneja, Preeti Thakur and Atul Thakur Name of Department/University/Campus: AINT, AU, Haryana</p>	 Preeti Thakur  Atul Thakur, AINT, AUH








38	<p>Title of Paper: Genome shuffling for phenotypic improvement of industrial strains through recursive protoplast fusion technology Name of Journal: Critical Reviews in Food Science and Nutrition Impact Factor: 11.18 Name of Author: Bedi N. Name of Department/University/Campus: AIB, AUUP, Noida</p>	 Dr. Namita Bedi, AIB, Noida
39	<p>Title of Paper: Recent insights on tea metabolites, their biosynthesis and chemo-preventing effects: A review Name of Journal: Critical Reviews in Food Science and Nutrition Impact Factor: 11.176 Name of Author: Mishra, R.K Name of Department/University/Campus: AIB, AU, Madhya Pradesh</p>	 Dr. Raghvendra Kumar Mishra AIB, AUMP
40	<p>Title of Paper: Nuclear Data Sheets for A=219 Name of Journal: Nuclear Data Sheets Impact Factor: 10.941 Name of Author: Jain, A.K. Name of Department/University/Campus: AINST, AUUP, Noida</p>	 Prof. A. K. Jain, AINST, AUUP
41	<p>Title of Paper: Evaluating the current status of protein kinase C (PKC)-protein kinase D (PKD) signalling axis as a novel therapeutic target in ovarian cancer Name of Journal: Biochimica et Biophysica Acta - Reviews on Cancer Impact Factor: 10.68 Name of Author: Tyagi K., Roy A. Name of Department/University/Campus: AIMMSCR, AUUP, Noida</p>	 Dr. Adhiraj Roy, AIMMSCR, Noida



42	<p>Title of Paper: Mitochondria: The metabolic switch of cellular oncogenic transformation</p> <p>Name of Journal: Biochimica et Biophysica Acta - Reviews on Cancer</p> <p>Impact Factor: 10.68</p> <p>Name of Author: Dr. Manoj Garg</p> <p>Name of Department/University/Campus: AIMMSCR, AUUP, Noida</p>	 <p>Dr. Manoj Garg, AIMMSCR, AUUP</p>
43	<p>Title of Paper: Recent advancements in therapeutic targeting of the Warburg effect in refractory ovarian cancer: A promise towards disease remission</p> <p>Name of Journal: Biochimica et Biophysica Acta - Reviews on Cancer</p> <p>Impact Factor: 10.68</p> <p>Name of Author: Tyagi K., Roy A.</p> <p>Name of Department/University/Campus: AIMMSCR, AUUP, Noida</p>	 <p>Dr. Adhiraj Roy, AIMMSCR, Noida</p>
44	<p>Title of Paper: Recent advances in understanding the molecular role of phosphoinositide-specific phospholipase C gamma 1 as an emerging onco-driver and novel therapeutic target in human carcinogenesis</p> <p>Name of Journal: Biochimica et Biophysica Acta - Reviews on Cancer</p> <p>Impact Factor: 10.68</p> <p>Name of Author: Tyagi K., Roy A.</p> <p>Name of Department/University/Campus: AIMMSCR, AUUP, Noida</p>	 <p>Dr. Adhiraj Roy, AIMMSCR, Noida</p>
45	<p>Title of Paper: Regulation of ascorbate-glutathione cycle by exogenous nitric oxide and hydrogen peroxide in soybean roots under arsenate stress</p> <p>Name of Journal: Journal of Hazardous Materials</p> <p>Impact Factor: 10.588</p> <p>Name of Author: Tripathi, D.K.</p> <p>Name of Department/University/Campus: AIOA, AUUP, Noida</p>	 <p>Dr. D. K. Tripathi, AIOA, AUUP</p>



46	<p>Title of Paper: Silicon crosstalk with reactive oxygen species, phytohormones and other signaling molecules Name of Journal: Journal of Hazardous Materials Impact Factor: 10.588 Name of Author: Tripathi, D.K. Name of Department/University/Campus: AIOA, AUUP, Noida</p>	 Dr. D. K. Tripathi, AIOA, AUUP
47	<p>Title of Paper: Targeting aquaporins to alleviate hazardous metal(loid)s imposed stress in plants Name of Journal: Journal of Hazardous Materials Impact Factor: 10.588 Name of Author: Tripathi, D.K. Name of Department/University/Campus: AIOA, AUUP, Noida</p>	 Dr. D. K. Tripathi, AIOA, AUUP
48	<p>Title of Paper: Hydrogen sulfide (H₂S) underpins the beneficial silicon effects against the copper oxide nanoparticles (CuO NPs) phytotoxicity in Oryza sativa seedlings Name of Journal: Journal of Hazardous Materials Impact Factor: 10.588 Name of Author: Tripathi, D.K. Name of Department/University/Campus: AIOA, AUUP, Noida</p>	 Dr. D. K. Tripathi, AIOA, AUUP
49	<p>Title of Paper: Fuzzy decision trees embedded with evolutionary fuzzy clustering for locating users using wireless signal strength in an indoor environment Name of Journal: International Journal of Intelligent Systems Impact Factor: 10.312 Name of Author: Achyut Shankar Name of Department/University/Campus: ASET, AUUP, Noida</p>	 Dr Achyut Shankar, ASET, AUUP
50	<p>Title of Paper: License plate recognition using neural architecture search for edge devices Name of Journal: International Journal of Intelligent Systems Impact Factor: 10.312 Name of Author: Soumya Ranjan Nayak Name of Department/University/Campus: ASET-CSE, AUUP, Noida</p>	 Mr Soumya Ranjan Nayak ASET, AUUP

Chapter – 3

PATENTS & COPYRIGHTS FILED

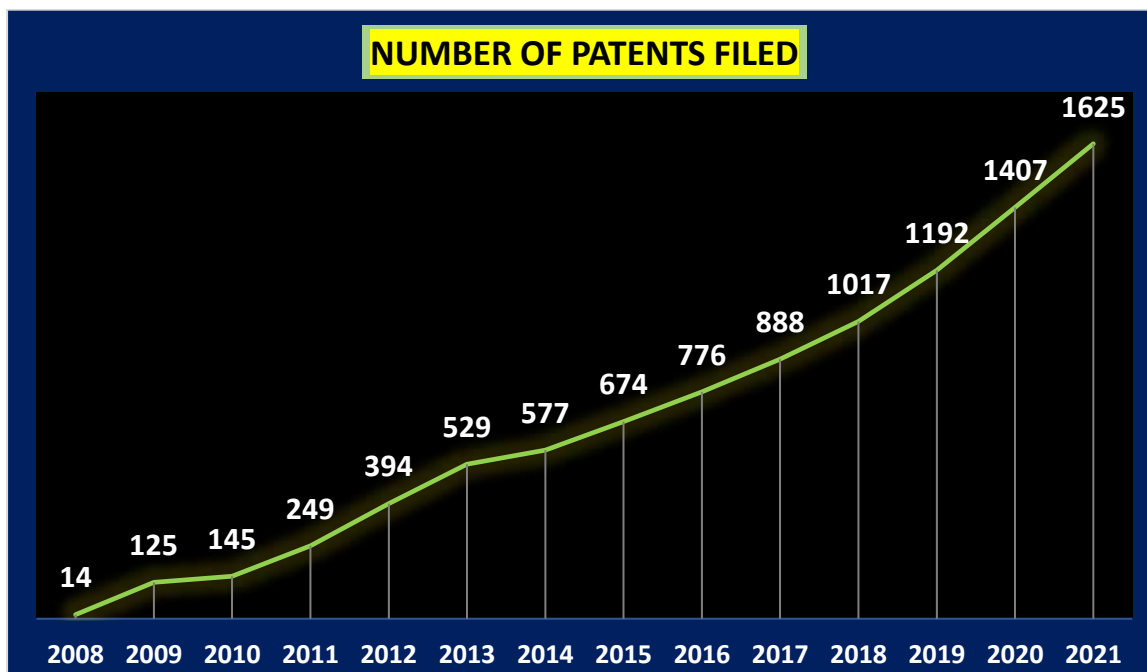
3.1 Amity has been credited to be one of the largest patent filing Institution at National level with a **total of 1625 patents** till 31 December, 2021 of which **218 were filed in 2021** itself. Out of these filed patents, **129** have been **granted** so far out of which **56** were granted during **this year itself**. In addition, **73 copyrights** were filed out of which **25** have been **registered**.

3.2 Indian Intellectual Property Office under the Department of Promotion of Industry and Internal Trade (DPIIT), Ministry of Commerce and Industry, Government of India has conferred **Amity University** as the winner of prestigious **National Intellectual Property Award for the year 2020** in the category of “**Top Academic Institution for Patent and Commercialization**”:



3.3 Quetsel India has also conferred **IP Excellence Award 2021** to **Amity University** in recognition for valuable contribution as an Innovation driven organization.

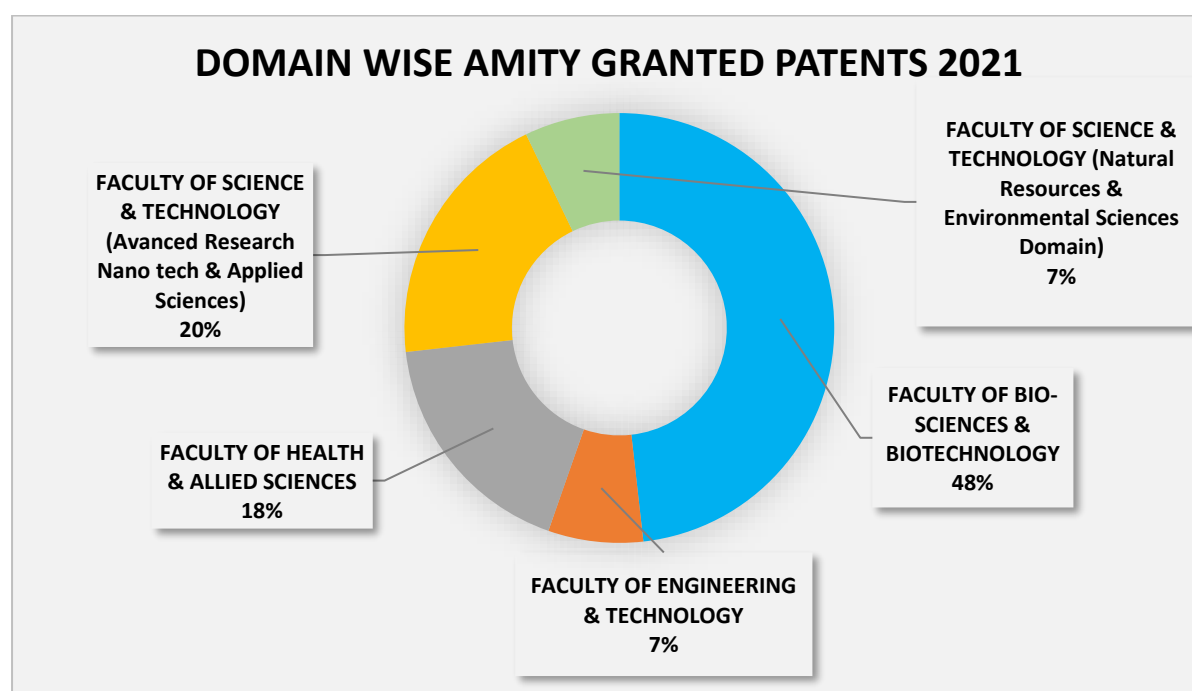
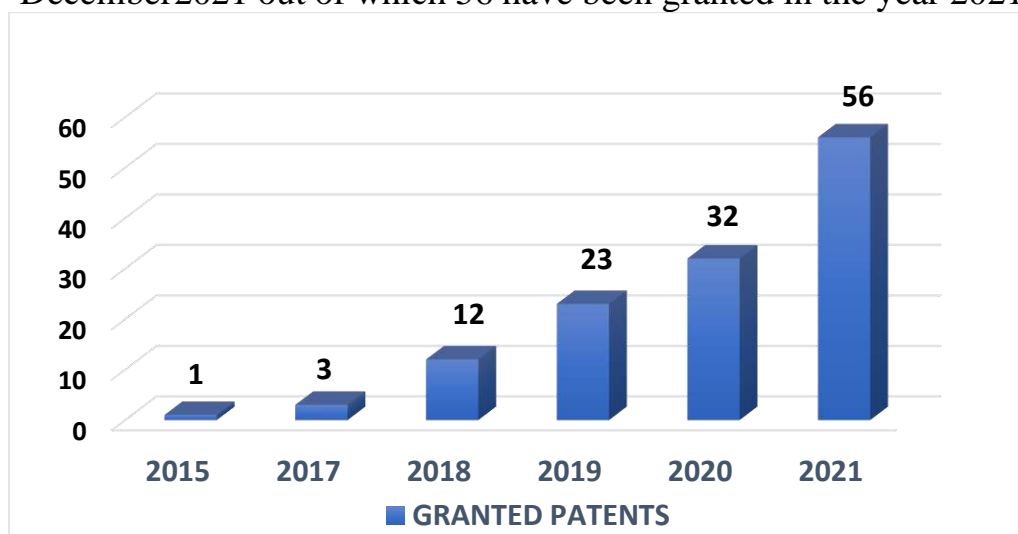
3.4 Graphical representation of Patents filed till date by Amity:-



3.5 The IP Analytics of the Group during the last year is shared below:-

Details	Figures for 2021
Number of Patent Application filed	218
Copyrights filed	73
Copyrights approved	25
Granted patents	56

3.7 PATENTS GRANTED: A total of 127 patents have been granted till 31st December 2021 out of which 56 have been granted in the year 2021.



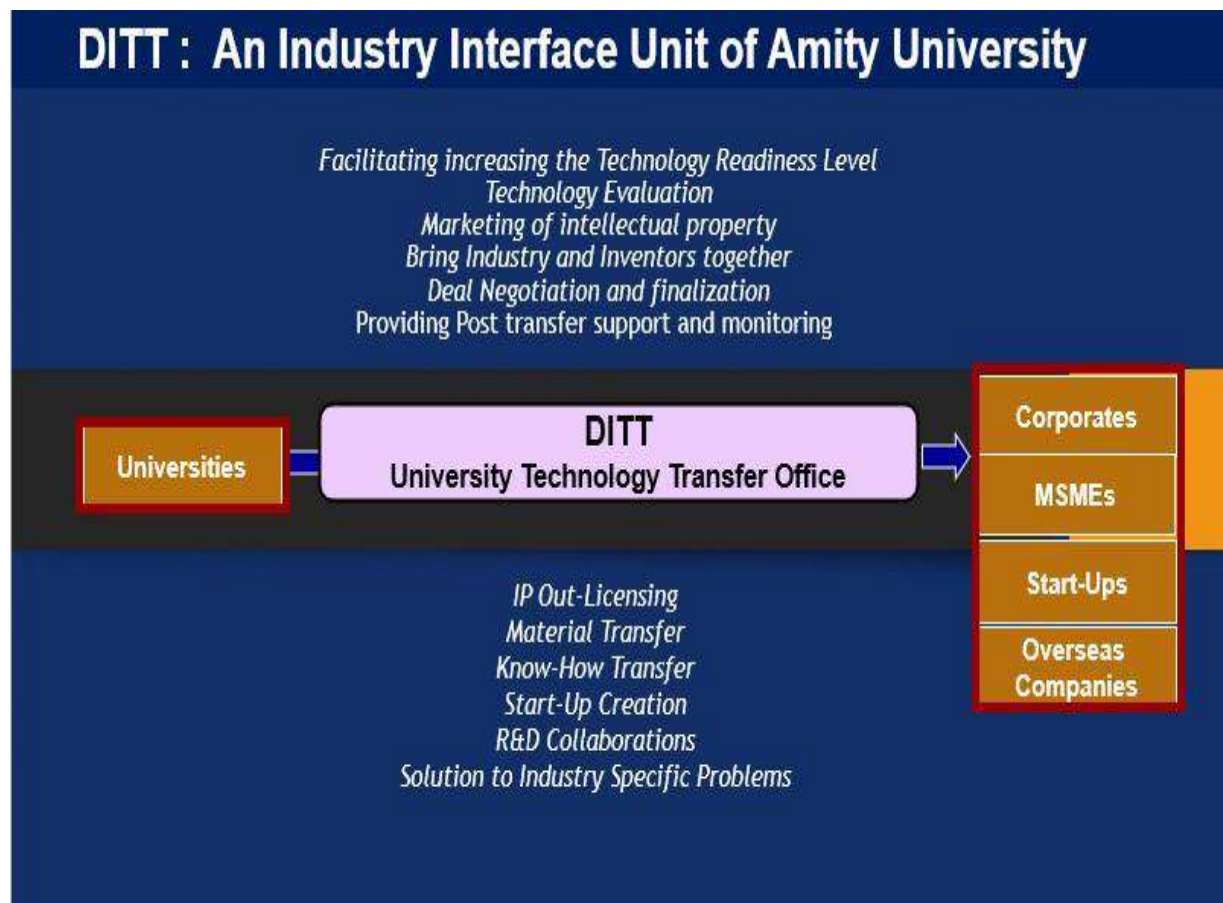
3.8 AMITY COPYRIGHT FILINGS

Copyrights Details	Total	2021
Copyrights Filed	133	73
Copyrights Registered	67	25

Chapter – 4

TECHNOLOGIES TRANSFERRED

Amity has been very conscious in bridging the gap between research output of the University and its application in industries. Accordingly, it has created the Directorate of Innovation and Technology Transfer (DITT) which functions as the Industry Interface of Amity University. The DITT functions with a clear vision of its role as an effective interface with the Industry to promote, develop, nurture and commercialize innovative technologies of Amity Universe for the mutual benefit. It is operating on the basis converting “KNOW-HOW” to “SHOW-HOW” and to “DO-HOW”.



4.1 Following **8 Technologies** have been transferred to the industries for commercialization in the current financial year :-

S.No	Name of the Technology/ Product	Name of University	Details
1	Rootonic	AUUP	Technology transferred to M/s. Sri Bio Aesthetics Pvt. Ltd., Hyderabad
2	Herbal Hand Sanitizer	AUUP	Technology transferred to NACL Industries Ltd
3	Electricity Generation and Waste Water Treatment	AUUP	Technology transferred to M/s.Deccan Water Treatment
4	Herbal Eco Cleaning (Plant Base)/Sanitation Products	AUUP	Technology transferred to M/s. Avirat Ichem Pvt. Ltd., Gujarat
5	Hiamachali Pickle	AUUP	Technology transferred to Suhana Masala
6	Rajasthani Pickle	AUUP	Technology transferred to Suhana Masala
7	All purpose sauce	AUUP	Technology transferred to Suhana Masala
8	Spice Tablet	AUUP	Technology transferred to Suhana Masala

4.2 Some of the **technologies which are in pipeline** with high potential for commercialization are:

- (i) Clever assay for COVID diagnosis
- (ii) Silver doped Copper nano-gel for rapid wound healing in diabetic patients
- (iii) Anti-viral Herbal Inhaler
- (iv) Biocompatible Film Wrap
- (v) HNB9 Formulation
- (vi) Food Technologies
- (vii) Pesticide detection Sensor
- (viii) Natural Products

7.3 The transfer of some of technologies have been initiated by signing NDA-MTA Agreement

S. No.	Name of the Technology/Product	Name of the Industry
1	Herbal Mosquito Repellent additive	British Paints
2	Limited for Biocompatible Film	NACL Industries
3	Natural Small Molecules as potential Bio-Pesticide against Rice Blast Fungus, Magnaporthe oryzae	Insecticides Ltd.
4	A bio-degradable herbal film for enhancement of shelf life of fruits and vegetable	1. M/s Lawrencedable Agro Processing
		2. Banana Producer in Tamil Nadu
5	A novel endophyte for plant growth promotion	Indofil Industries
6	Injection Moldable Bio-plastic	Cosmos Eco friends
		M/S Prathista Industries Ltd
7	A method and formulation for plant growth promoting consortia of Talaromyces Purpureogenus HNB9 and Bacillus Subtilis	ICL Innovations, Israel

4.4 A Technology Enabling Centre (DST-TEC) fully funded by DST has been established IN AUUP Noida to upgrade Technology Readiness Level (TRL) and to make them Industry ready. Technology Readiness Level of following technologies have been upgraded during the year:

S. No.	Title of the technology	Name of the Inventor
1.	Natural polymer-based gelatin free capsules	Dr. Harsha Kharkwal
2.	Driver Identification System	Mr. Saket Kumar
3.	Portable Safety Device for Sewer Worker	Mr. Saket Kumar
4.	A Novel Endophyte for plant growth promotion	Dr. Amit Kharkwal
5.	Biocompatible and biopolymer based herbal coating for enhancement of shelf life of perishable fruits	Dr. V. Pooja
6.	Injection Mouldable Bio-plastic	Dr. Harsha Kharkwal

Chapter – 5

AWARDS & FELLOWSHIPS

5.1 Awards and competitive fellowship are reflective of third-party endorsement about the quality and achievements of Amitians. Keeping this in view Amity, as a policy keeps encouraging its faculty/researchers and students to participate at National & International forums for research and Innovation as well as Academics.

5.2 In recognition of excellence and outstanding accomplishment in research and Academics, the brilliant and dynamic faculty members of Amity Education Group have been bestowed with more than 66 awards and 36 fellowships/Scholarships in the year 2021.

5.3 Over and above this, 38 faculty members have also been recognized for their outstanding work by various agencies such as, Department of Biotechnology (DBT), Ministry of Cooperative Department, Government of Rajasthan, Royal Society of Chemistry, Royal Society of Biology, Frontiers in Materials Journal, NASA India, Frontiers in Psychiatry - Psychological Therapies, RELO, U.S. Embassy, International Culinary Union (ICU), London UNIVERSITAS VARSOVIENSIS (Warsaw University), University of California, Davis, USA European Association for the Study of the Liver etc.

5.4 University wise summary of details of Awards, fellowships and recognition are as under:

Name of University	Awards	Fellowships/ Scholarship	Recognition
Amity University Uttar Pradesh Noida	34	19	28
Amity University, Haryana	8	0	0
Amity University, Madhya Pradesh	7	11	6
Amity University, Rajasthan	3	1	1
Amity University, Mumbai	8	6	1
Amity University, Kolkata	0	3	2
Amity University, Chhattisgarh	8	0	0
Total	68	40	38

5.5 **Fifteen** Amity University faculty members figure in **top 2%** of Global Researchers from India, in the list compiled by Stanford University, USA.

5.6 Dr. Durgesh Kumar Tripathi from Amity Institute of Organic Agriculture, Amity University Uttar Pradesh has been recognised as one of the “**Highly Cited Researcher 2021**” by Clarivate Analytics. Dr. Durgesh is among the 22 Indians who has been recognised in this list of **top 1% Scientists** in the world.



Highly Cited Researcher 2021



5.7 Glimpse of Awards

GLIMPSE OF AWARDS

**Amity University has been conferred upon
 “Top Indian Academic Institution for Patents & Commercialization Award 2020”**





Fifteen Amity University Scientists figure in top 2% of Global Researchers from India, in the list compiled by Stanford University, USA














Chapter – 6

COLLABORATIONS

6.1 MEMORANDUM OF UNDERSTANDING (MOU) SIGNED

- MoU's can be seen as the starting point for building collaboration and plays a vital role in bridging the gap between Industries, Academic & Government agencies for increasing the academic and research capabilities of both organizations. Amity University encourages and facilitates collaboration amongst National and International research-oriented organizations to promote multidisciplinary, cross- disciplinary as well as transdisciplinary research for Societal well-being.
- Amity has signed a total of 286 MoUs (91 National and 195 International) of out which **120 MoUs i.e; 62 National and 58 International have been signed-in 2021.**

6.3 CONFERENCES/WEBINARS/VISITS ORGANISED IN 2021

- Amity among various other initiatives for facilitation of cross-fertilization of ideas and thoughts, regularly organizes visits/ lectures for igniting the research acumen of its brilliant and dynamic faculty members/ researchers.
- The group has organized more than 1350 webinars of global relevance during the year during the lockdown period for keeping its faculty members and researchers updated with recent technological advancement in their field of research.
- In addition to this, 159 Conferences, Seminars and workshops as well as 125 FDPs were organized using online mode.

6.3 HONORARY DOCTORATES/ PROFESSORSHIP

HONORARY DOCTORATES/ PROFESSORSHIP

- 7 Honorary Doctorate degrees have been bestowed to distinguished persons who have made a mark at National and International level for their outstanding research & academic contributions and leadership. In addition, the University has also awarded 28 Honorary Professorships to renowned Scientists, Industrialists, Technocrats in the year 2021.

Chapter – 7

RESEARCH CLUSTERS

7.1 Research Clusters:

- Amity has made a new initiative under “Mission Synergy” through which brilliant scientific brains are brought on a common platform. For this a concept of Research cluster has been initiated in the part with following objectives.
 - a) To promote the connectivity among the experts in particular cluster.
 - b) To give force multiplier effect to the thoughts through interaction of various minds working in a specific area together in functional cluster mode.
 - c) To share latest updates on the cluster regarding the particular research area. Formulation of multidisciplinary integrated projects for submission to the funding agencies.
 - d) To have regular interactions on WhatsApp group specifically created for this cluster.
 - e) To identify advisors from outside Amity for specific research sub clusters, who can interact with members of the clusters on various research activities.
- A total of 50 frontier areas of global relevance has been identified out of which activities under 10 clusters has already started. The following 7 clusters which are socially relevant with national importance and global significance were initiated in the year 2021 for accelerating the expression of ideas and concept emanating in the minds of our faculty members/researchers.

Chapter – 8

RESEARCH HIGHLIGHTS

I : TECHNOLOGIES & PRODUCTS DEVELOPED

a) Amity University Noida

- **Filomicelles of combination drugs for the treatment of Brain Diabetes**

Metformin is an oral diabetes medicine that helps to control blood glucose level. It belongs to biguanide class of antidiabetic drug. It is often prescribed in combination with other antidiabetic drug like rosiglitazone (Avendamet), pioglitazone (Actoplusmet) etc. These combinations are effective but have shown its toxicity in liver and other clinical problems like lactic acidosis, cardiovascular diseases and many more. Epicatechin enhances the release of insulin and helps in the conversion of proinsulin to insulin *invitro*. Also, it stimulates the uptake of oxygen by the adipose and muscle cells and enhances the glycogen content in a dose dependent manner. PHA/PHB was used for designing delivery system. It is biodegradable, biocompatible and extracted from bacteria. It is inert and safe for body.

Dr. Deepshikha Pande Katare from Amity Institute of Biotechnology has developed a method of using Metformin and Epicatechin. The combination primarily uses Filomicelles of Metformin along with Epicatechin. The present invention provides the target drug delivery to brain insulin receptor to increase brain insulin sensitivity.

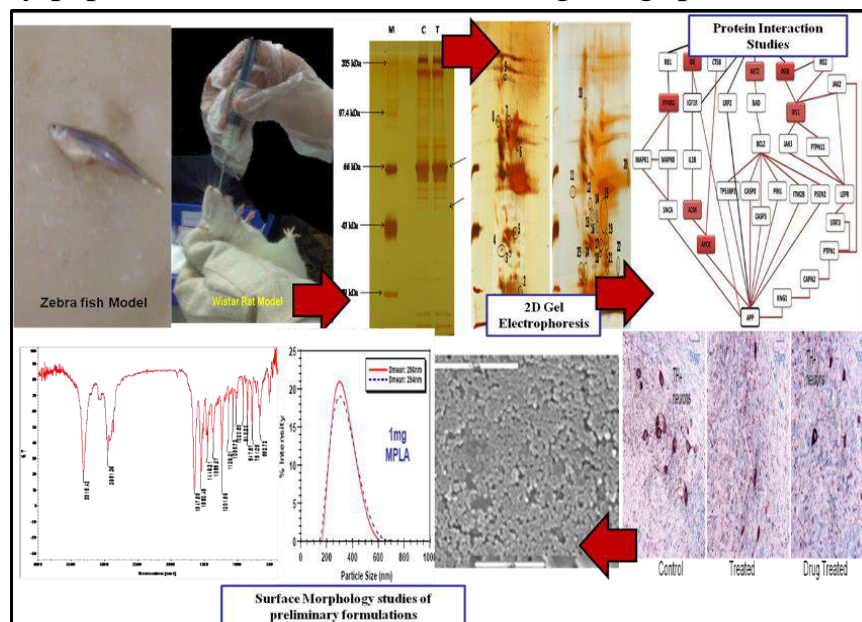
Need and Demand

- Brain Diabetes/Type 3 Diabetes should be **treated as a clinical entity. As there is no drug available in the market for this pathology, the proposed drug will offer a solution for this disease.**
- PHA/PHB is **biocompatible polymer and non-toxic** for human system. It is extracted from bacteria and hence is **cost effective.**

Metformin and Epicatechin are synergistic drugs and the pair offers a unique combination of **neuroprotection and antidiabetic properties** so that a **single drug can target this dual pathology**.

Market Information

- Currently there are no competitors for the medicine used in the management of T2DM induced AD (T3D) as it is the new and unexplored pathology, Hence the market for the current technology can be huge and it may impact the current market of medicines used individually for the two pathologies i.e. T2DM & AD separately.
- According to data from healthcare information provider QuintilesIMS, The overall market size of diabetes drugs in India is Rs10,534 crore In 2016, the global sales of Trulicity reached \$926M, with 2.1% of worldwide market share. In India only over the last 5 years Lupin's current diabetes products' basket includes different classes of drugs such as oral hypoglycemic agents (OHAs), insulins and novel drugs like sodium glucose co-transporter-2 (SGLT-2) inhibitor drug empagliflozin, and Dipeptidylpeptidase-4 (DPP-4) inhibitor drug linagliptin.



Schematic representation of preliminary work done on Type 3 Diabetes A) model development B) Proteomic Analysis C) Protein Interaction Studies D) IHC images. E) Surface Morphology of preliminary formulations

Future Developments

- Preclinical studies are already completed and molecular efficacy of the formulation has been validated. Human validation of the technology will be carried out in future.

- **A novel synergistic formulation for inhibition of tumor growth and method of preparation thereof**

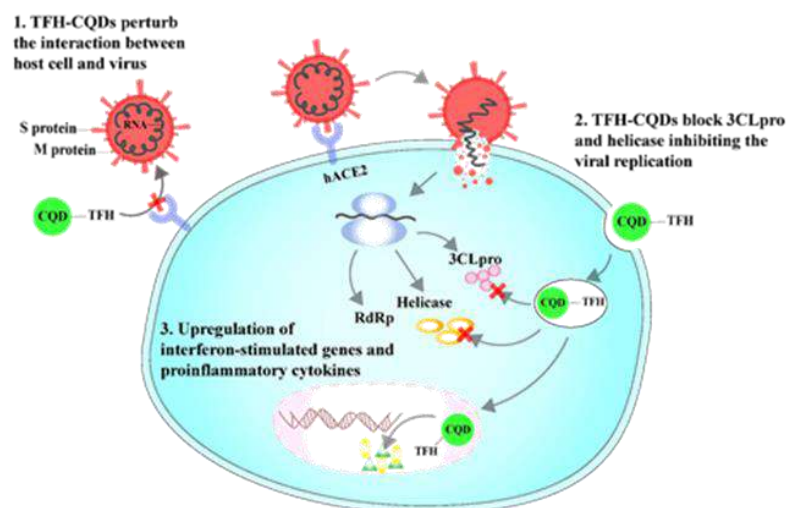
Dr. Deepshikha Pande Katare from Amity Institute of Biotechnology has developed a novel synergistic formulation comprising **therapeutic** effective amount of sorafenib hydroxyethylate with vitamin K2 and Tran's chalone for tumor growth inhibition in hepatocellular carcinoma. The present method for the preparation of novel synergistic formulation is simple, cost effective and user-friendly. In the present synergistic formulation sorafenib hydroxyethylate has hydroxyethyl group on the main pharmacopore ring forming a cationic derivative.

Need and Demand

- It is a novel synergistic formulation for tumor growth inhibition and method of preparation thereof.
- It provides a method for the preparation of synergistic formulation that has no side effects.
- It provide a therapeutic formulation that can be taken in the form of tablets, capsules as well as drops
- Market Access Information
- According to Bayer's sales forecast the exchange rates as of June 30, 2017, including a rate of US\$1.14 (previously: US\$1.07) to the euro. A 1% appreciation (depreciation) of the euro against all other currencies would decrease (increase) sales on an annual basis by €300 million and EBITDA before special items by €80 million.



- The scientists from Amity Institute of Click Chemistry & Research studies have worked on following aspects during the year
- a) Dr. Monalisa Mukherjee has made exemplary contributions to the field of materials science. Her pathbreaking research is not only reinforced by her remarkable publications and patents but also by the translational potential of her work in the area of **bioimaging, targeted delivery and diabetic wound healing**. Her explorations have significantly enabled to bridge across science and bioindustry disciplines where chemistry plays a major role. She has recently secured a collaboration between her institute AICCRS and Jubilant Biosys in diabetic wound healing. This is a momentous step towards the translation of state-of-the-art materials and a remarkable societal impact of Dr. Mukherjee's research. In the current scenario of coronavirus pandemic she has published a paper in Nano today (Impact factor ~20.1) entitled “Exploring the role of triazole functionalized heteroatom co-doped carbon quantum dots against human coronaviruses”.



2. Dr. Ranjan Patra: Multicomponent reactions are attracting strong interest as they contribute to the development of more efficient synthetic chemistry. Understanding their mechanism is thus an important issue to optimize their operation. However, it is also a challenging task owing to the complexity of the succession of molecular events involved. Computational methods have recently proven to be of utmost interest to help decipher some of these processes, and the development of integrated

experimental and theoretical approaches thus appears as the most powerful means to understand these mechanisms at the molecular level.

A good example is given by the synthesis of amidines which are important pharmaceutical compounds. Their synthesis requires the association of three components, often an alkyne, a secondary amine, and an organic azide as the nitrene precursor. Dr. Patra found that an alternative way is offered by an Fe-catalyzed combination of a hydrocarbon, a nitrile, and a nitrene which gives amidines in good yields under mild conditions. The efficiency of the transformation and the paucity of mechanistic information on these reactions prompted us to thoroughly investigate its mechanism. Several mechanistic scenarios were explored using experimental techniques, including radical trap and ^{15}N labeling studies, combined with density-functional theory (DFT) calculations of reaction profiles. This allowed the team to show that the amidination reaction involves the trapping of an intermediate substrate cation by an Fe-released acetonitrile molecule pointing to a true multicomponent reaction occurring exclusively within the cage around the metal center. Moreover, the calculated energy barriers of the individual steps explained how amidination outweighs direct amination in these reactions. The perfect consistency between DFT results and specific experiments to validate them strongly supports these mechanistic conclusions and highlights the potency of this combined approach.

3. Dr. Saikat Dutta: Functional Materials for Intracellular and Energy Applications

The major focus of Dr. Dutta's research is to develop biologically functionalized and biomass-derived novel functional materials for therapeutic and energy storage applications. Currently we developing our research strategies based on the following directions:

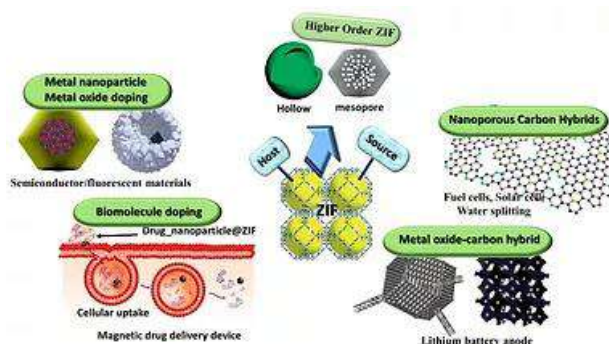
✓ Biofunctionalized Frameworks for Biomedical Applications

Novel strategies of biofunctionalization of framework architecture is in great demand due to their unexplored potentials as delivery agent of biomolecules into cellular events via both in vivo and in vitro studies. The aim is to develop a series of biofunctionalized frameworks by aiming their application as therapeutic agents for healing of a range of biomedical problems.



✓ Functional Materials for Energy Storage

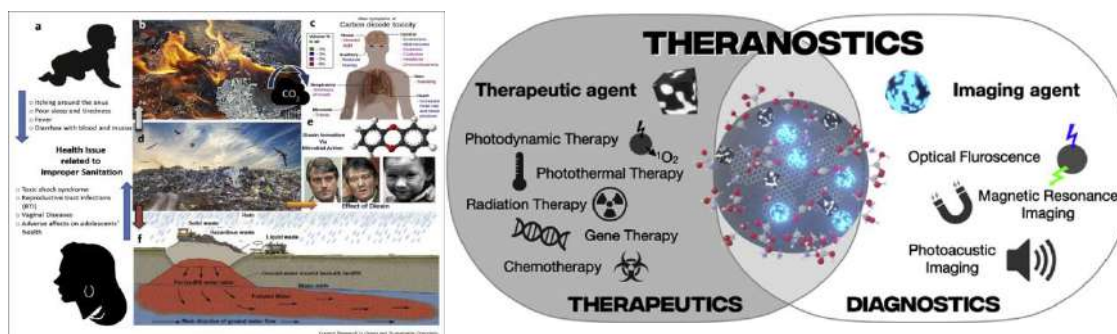
Exploring the microporous ZIFs as host and source of energy applications is a new paradigm of applications of ZIF materials. Enzyme encapsulated ZIFs to protect enzyme with a shell to induce properties to exhibit certain inhibitor tolerance and selectivity depending on the diameter of the micropores of ZIF shell. ZIF-derived curved graphene for extra-large charging application is another direction to explore. Following Figure3 features the above proposed emerging applications of ZIFs from which most may have potential energy applications.



4. Dr. Vivek Mishra:

Currently, the greatest environmental danger posed by biowaste (and other biodegradable waste) is the creation of methane from such trash degrading in landfills, which accounted for approximately 3% of total greenhouse gas emissions in the EU-15 in 1995. The issue of appropriate waste management is a top priority in both industrialized nations and emerging ones. The implementation of circular economy concepts permits if effectively implemented, the preservation of secondary resources in the production circuit as well as the protection of primary reserves. Dr. Misra's team is currently focusing on research and case studies that examine the issue of waste management not only from a technical and

engineering standpoint, addressing innovative solutions, but also from an economic standpoint, focusing on the main challenges and opportunities in the cycle of waste recycling, recovery, regeneration, and reuse, as well as the necessary involvement of the population, as a fundamental element on which the applicability of the circular economy principles is dependent.



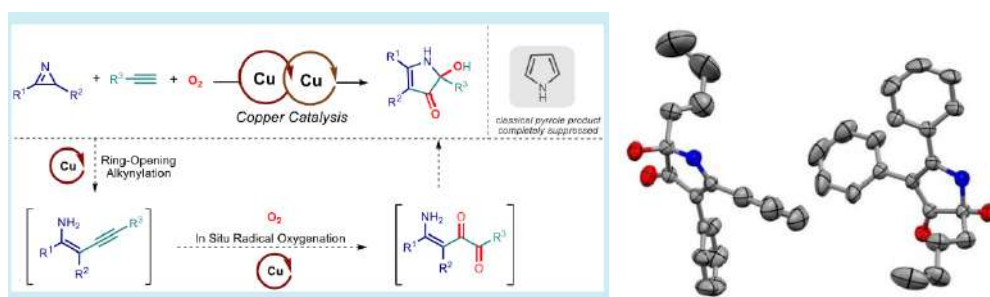
They In our lab, we are utilizing bio-waste materials, to develop carbon quantum dots, which we can be utilized as photocatalysts for organic transformation, to improve efficacy of drug delivery, various biomedical applications, as well as sensors.

5. Dr. Kayambu Namitharan: Harnessing In Situ Radical Oxygenation: Copper-Catalyzed Interrupted Azirine–Alkyne Ring Expansion Reaction for the Synthesis of Pyrrolones

Natural and synthetic pyrrolones have attracted wide- spread attention in medicinal chemistry because of their broad spectrum of biological activities, including anticancer, antibacterial, antiviral, and anti-inflammatory therapeutic properties. Their promising bioactivities and possible synthetic elaborations make pyrrolone structures particularly important targets to inspire and develop new synthetic methodologies. Recently, radical functionalization has proved to be a powerful approach for the efficient construction of challenging molecular fragments. In particular, in oxygen- ation reactions it can directly introduce carbonyl functional groups under milder conditions, and thus, more challenging products can be effectively synthesized. Significantly, when alkynes are subjected to oxygenation conditions, synthetically valuable 1,2-diketones are obtained as products. Consequently, numerous synthetic efforts have been made in this area by employing both transition metal catalysts and photocatalysts.

In this regard, recently, we reported a novel interrupted azirine–alkyne ring-expansion reaction with molecular oxygen for the direct synthesis of

highly functionalized pyrrolones enabled by copper catalysis. Mechanistic investigations indicate that the present three- component reaction proceeds via two copper-catalyzed sequential reactions, an azirine-ring-opening alkylation and an amine- directed radical oxygenation, leading to the formation of interesting pyrrolone structures under mild conditions. The structure of the product was determined by NMR spectroscopic analysis and X-ray crystallography (Figure 1), which confirmed that oxygen is incorporated into the product.



To gain more mechanistic insight, a series of control experiments were performed. When the reaction was performed in the presence of the radical quencher 2,2,6,6-tetramethylpiperidin- 1-oxyl (TEMPO), the desired product 3a was obtained in only trace amounts, indicating a radical pathway for the reaction. Notably, the reaction conducted with dry ACN in the presence of molecular sieves proceeded with the same efficiency, suggesting that residual water has no significant role in the present reaction. On the other hand, no reaction took place under an argon atmosphere. Also, other oxygenation catalysts like potassium persulfate and potassium peroxydisulfate failed to produce the desired products under argon atmosphere conditions. These results suggest that the oxygen atoms in the products are from molecular oxygen and not from trace amounts of water present in the acetonitrile. Furthermore, to confirm the role of the amine group of the yne–enamine intermediate in the radical oxygenation, other simple alkynes such as phenyl- acetylene and diphenylacetylene were subjected to the present reaction conditions. However, oxygenated products were not formed in these cases. Therefore, the amine group must have played a crucial role in the second alkyne oxygenation by chelating the copper catalyst and directing molecular oxygen to the nearby alkyne functionality.

In summary, the team has developed a new copper-catalyzed three- component relay alkylation/oxygenation strategy to deliver interesting 3-pyrrolone structures from azirines, alkynes, and molecular oxygen. Overall, this report demon- strates that by the use of sterically hindered diaryl azirines and a Cu/TEA catalyst system, self-cyclization between the

in situ- generated skipped yne–imine and yne–enamine intermediates can be completely suppressed, allowing them to be used for further reactions. Investigations in this direction are currently underway in our laboratory.

• **Research undertaken by Amity Institute of Food Technology**

1. Studies on phytonutrients composition of *Cordia dichotoma* fruits and their potential application in the development of functional food: The crop is highly economical and the scientists are working on the evaluation of the functional properties, phytonutrients composition and utilize its extracted gum it in the formulation of functional food.
2. Characterization, Functional Properties and utilisation of Protein hydrolysates from underutilised pulse crop: *Macrotyloma uniflorum* (Lam) Verdc: To prepare, characterize and utilize protein hydrolysates from horse-gram which will help in development of functional food
3. Impact of Nutritional Intervention and nutrition education in Improving Iron deficiency Anemia among rural adolescent girls: Keeping in view, the importance of adolescent period in human life and nutritional problem of adolescent girls, the present study has been planned to assess the Impact of Nutritional Intervention and Nutrition Education in Improving Iron Deficiency Anaemia among Rural Adolescent Girls to combat iron deficiency anemia among rural adolescent girls, nutrition education material and food products rich in iron will be developed. The major focus was on Food Synergy of Fe with Vitamin C.
4. Minor Forest Produce and underutilized fruits : A composite machine and value-added products from neem have been developed under the Research Project ' Value Added Chain linkage for neem seeds and fruits' granted by TRIFED, Ministry of Tribal Affairs, GoI. Also, low-cost processing technologies have been developed for Tendu (*Diospyros melanoxylon*) fruit in collaboration with TRIFED to enhance the income generation of Tribal people. The RTE and other value-added products like dehydrated slices and powder have been developed from Loquat fruit (*Eriobotrya japonica*). These products have a huge commercial and industrial potential.
5. Hybrid drying techniques for drying of banana peel, so that banana peel powder can be utilized for development of value added products.
6. Evaluation and Development of Supplementary Food for Lactation

The pregnant women and lactating mothers are considered as the vulnerable group specifically in the emerging countries. The requirement of nutrients increases at the time of pregnancy and lactating period and therefore proper nutrient supply is very essential in both the cases. Foods

consumed by several lactating mothers in our country are poor and lack in many nutrients. There is an increased requirement of protein and calcium as well during this period due to milk secretion. Therefore, the project aims at evaluating the nutritional needs of Indian lactating women and developing a nutritious food to supplement their nutritional needs, and elevate and maintain nutritional status by using standard formulations and incorporation of cost-effective traditional ingredients.

To identify the gaps in the nutrient intake and identification of traditional super/special foods consumed by lactating mother, data was collected using questionnaire which included general profile of the lactating mother. On the basis of results obtained, preparation of functional food i.e., Nutri mix and Snack Bar using natural ingredients were formulated which were expected to fulfil the nutritional requirements of the lactating mothers.

Several educational trainings were conducted in the project. Women of Bisrakh block, Uttar Pradesh from 18-30 years of age were targeted having children from 0-2 years of age. The training included topics on Nutrition during Lactation and Maintenance of Hygiene during Covid- 19.

- ***Amity Institute of Nuclear Science and Technology, Amity University Uttar Pradesh*** in collaboration with the ***Centre for Nuclear Security Science & Policy Initiative (NSSPI), Texas A & M University (TAMU) USA*** , establishing a ***state-of-the-art laboratory*** which is one of its kind, for education and professional development in nuclear science and nuclear security and safety.

The lab will consist of the equipment, which deal with.

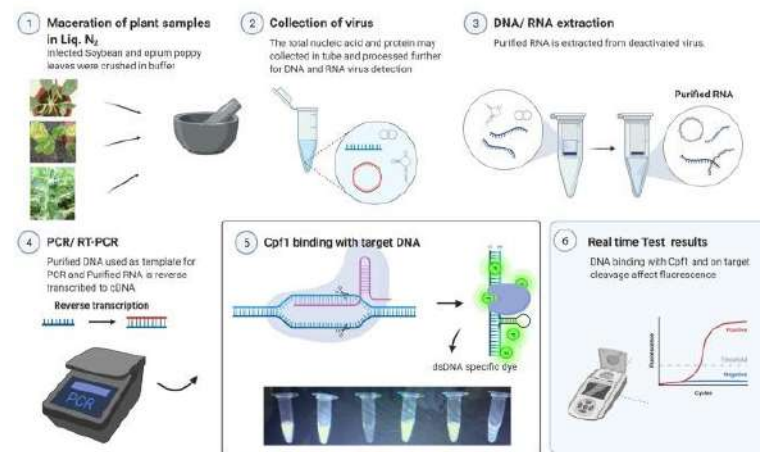
- ✓ Radioisotope identification devices
- ✓ Alpha aria
- ✓ Scintillator (CeBr) and HPGe multiple detectors.
- ✓ Nuclear detector remote lab, which being a unique facility will help students and scholars, to access the instruments to perform nuclear practical, from their respective institutes.

• **Research at Amity Institute of Virology & Immunology**

1. Development of a new Collateral Cleavage-independent CRISPR/Cas12a based easy detection system for plant viruses

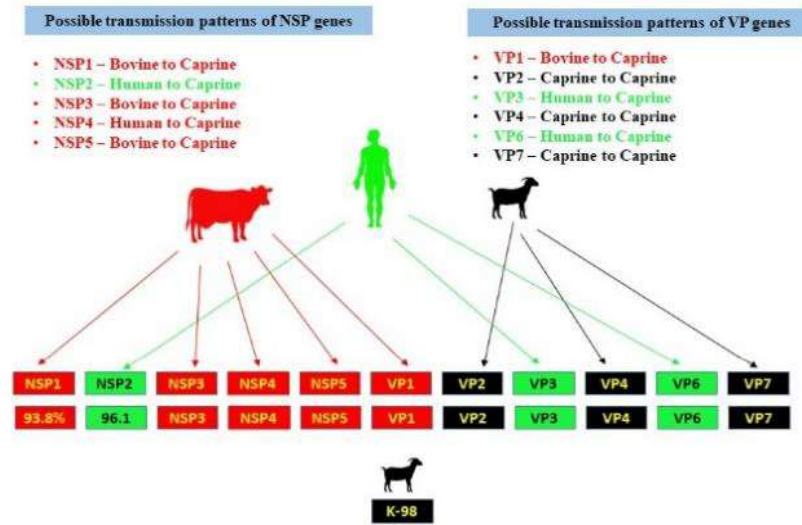
CRISPR/Cas12 based viral detection gain popularity during the COVID-19 pandemic. All the Cas12 and Cas13 based diagnostic methods are associated with collateral cleavage of single stranded probes. To minimize the cost of the detection, we introduce CCI method for diagnosis of plant virus genome. This technique utilizes specific dsDNA binding dye for detection.

Diagnosis of Plant viruses through Cpf1 binding with DNA



2. Prevalence and Genomic Characterization of Small Ruminant Rotaviruses

The objective of the study was to identify and characterize small ruminant rotavirus A (RVA) present in the feces of goat and sheep population of India by means of molecular diagnostics for obtaining an epidemiological data of RVA and to report a whole genome-based sequence data of small ruminant RVA rotavirus. The study describes the prevalence of rotavirus A associated with small ruminant gastroenteritis based on a large-scale survey of six Indian states of Northern and Southern India. For the first time a whole-genome-based characterization of a caprine rotavirus A strain, RVA/Goat-wt/IND/K-98/2015, from a goat kid in India was achieved in the study.



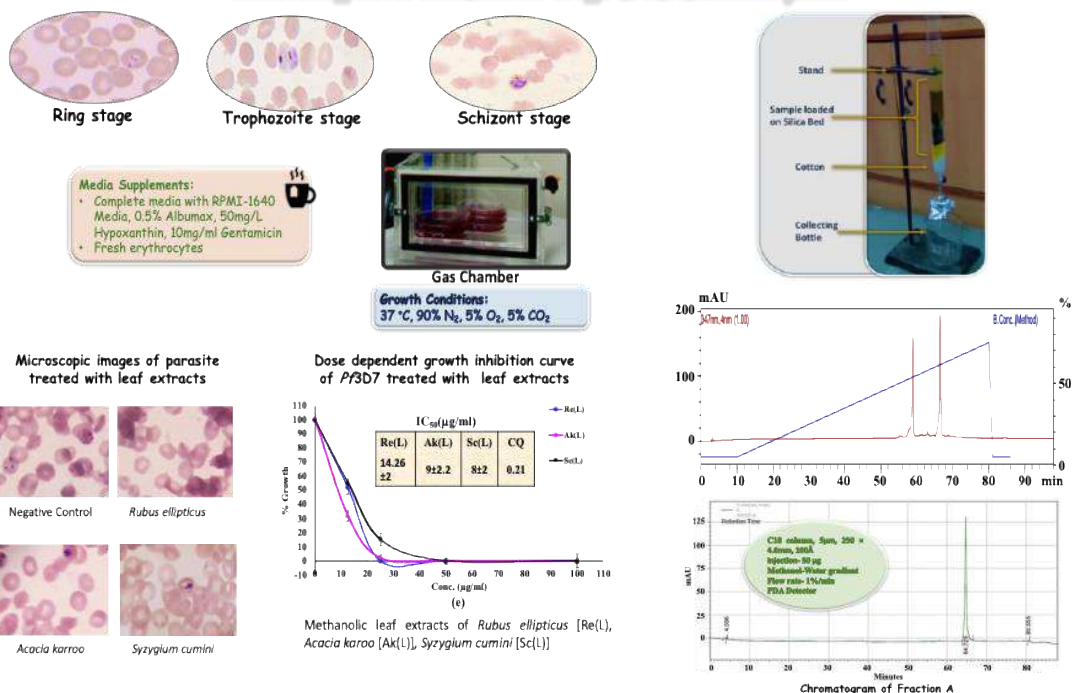
3. CRISPR/Cas System: A Revolutionary Technique Applied Potentially from Diagnosis to Therapeutics in COVID-19

This MS describes information of the emergence of Coronavirus disease-2019 caused by SARS-CoV. It summarizes and discusses in detail about the novel therapeutics and diagnostics developed to date to control this disease. Role of CRISPR/Cas is discussed in detail for novel therapeutics and diagnostics development.

4. Discovering novel antimalarial drugs from medicinal plants

Plants collected from different regions of India showed promising in vitro antimalarial activity and they are non-toxic to mammalian cells. Three leaf extracts, *R. ellipticus*, *A. karroo* and *S. cumini* have significant in vitro as well as in vivo antimalarial activity as their oral dose suppressed growth of parasite by 52-64% in *P. berghei* (ANKA) infected mouse model. Fractionation of the three active crude extracts led to enrichment in their antimalarial activity by reducing IC50 values. Bio-assay guided fractionation of *R. ellipticus* led to the isolation of two molecules. Purified molecules showed promising antimalarial activity and were found to be non-toxic to mammalian cell lines.

Discovering novel antimalarial drugs from medicinal plants



5. Biological and molecular characterization of two isolates of apple stem grooving virus revealed distinct properties and indicates virus emergence driven by recombination

Complete genomes of two isolates of ASGV were characterized biologically and molecularly. The isolates shared 97% sequence identity with each other. Recombination analyses suggest isolate MK and p12 as non-recombinants, but recombination events increased with increasing host diversity. The findings here also suggest that this virus is emerging with expanding host range breadth and diversified host adaptability driven by recombination.

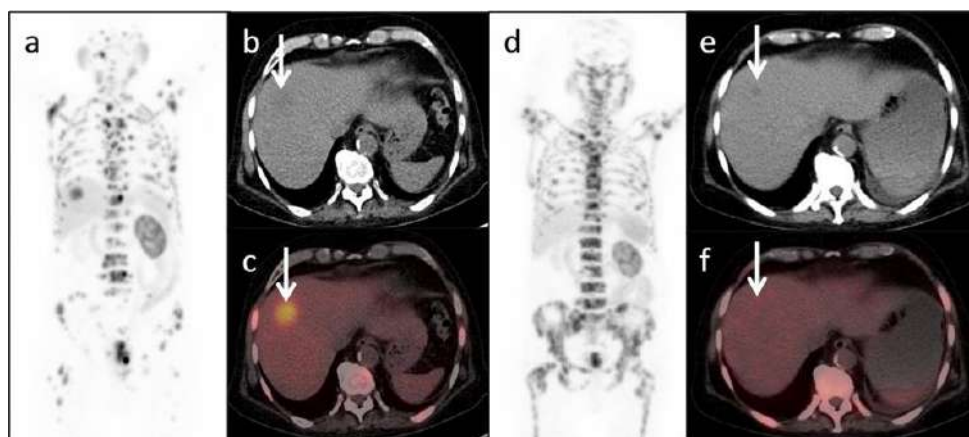
6. New host of Apple stem grooving virus

Viruses are increasing their host range. This will lead to more economic losses if new host are commercial crops of economic value. loquat (*Eriobotrya japonica*) was identified as new host of Apple stem grooving virus. Three virus genes viz. coat protein, movement protein and Rep protein were amplified cloned and sequenced.

7. Role of Radio-Ligand in Theragnostics of Metastatic Castration Resistant Prostate Cancer

The role of Lu177-PSMA (Prostate Specific Membrane Antigen) as a theragnostic was evaluated in mCRPC patients. Theragnostic' is a

combination of two words ‘Therapy and Diagnostics’. It was concluded that one cycle of Lu177-PSMA therapy is an effective treatment option in end-stage mCRPC patients. Despite low-performance status, it provides effective pain palliation and analgesic control in our study group. It is also concluded that it is a safe therapeutic option and an adequate bone marrow reserve is the crucial parameter to avoid any clinically significant toxicity.



- **Research at Amity Institute of Phytochemistry and Phytomedicine**

1. Vegetarian Capsules

The advancement in science and technology makes it easier for one to make their own supplements. Vegetarian capsules are healthier as these are derived from natural ingredients such as cellulose, hydroxyl and methyl.

Vegetarian capsules are plant-derived, meaning that the capsules' composition is made up of plant derived materials. For people who have religious or dietary restrictions, these capsules are ideal. As ingredients are made from plants, people who are sensitive to dairy or wheat would find them a better alternative.

The present invention of Amity Scientist relates to a novel formulation for vegetarian hard capsule comprising cassava starch along with hydroxymethyl cellulose guar gum and Cassia grandis gum along with pectin and other additives and a method of preparing the same. These properties of the vegetarian hard capsules exhibit high tensile strength and are at par with the gelatin capsules. The vegetarian hard capsules are free of cracking, completely natural, low in moisture content and resist brittleness. They also inhibit microbial activity and have a higher shelf life.

The method for preparing the capsule comprises the steps in which the biphasic blend of two phase is used. The first phase comprises polysaccharide and the second phase consists of galactomanan which acts as a filler for the first phase blended together at 65°C with water as solvents and finally dipped in the mould and dried in a chamber maintaining 20% humidity and further coated with polysaccharide for drying of water.

Vegetarian Hard Capsules



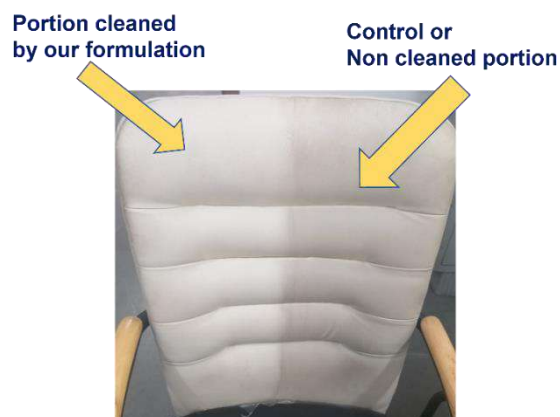
Effect of Temperature and Time on capsules



2. Novel Leather Cleansing Formulation

Novel formulation for leather cleansing prepared with conditioning effect, it is customizable for nylon, polyester good as well as other surfaces like wood and metal. Safety profile of all components is well established without associated safety concern. Formulation is free from hydrochloric acid, phosphates, ammonia, chlorine, and bleach.

Operation of preparation is unique, which involve in-situ generation of key cleansing ingredient, easily scalable to large production unit. Unique method of preparation has significantly reduced the cost of the final product. Formulation leaves a smooth, hydrophobic and dust resistant layer upon evaporation. Provisional patent of formulation filed, and preliminary quality control parameters are established. Details of formulation shared with DITT, Amity University for Technology Transfer.



Bag before Cleaning

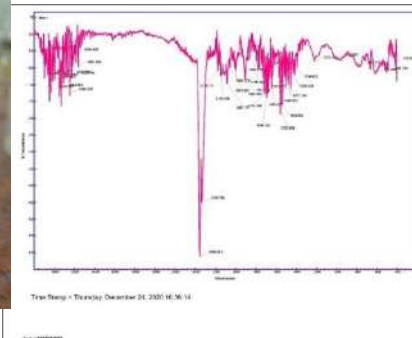


Bag After Cleaning with formulation



3. Novel anti-microbial coating formulation

Copper-tannic acid nanoparticles (CT NPs) prepared with economic and scalable process. The characterization of CT NPs using XRD, SEM, FT-IR and TGA revealed its nano size with desirable features. Special coating ink prepared using the CT NPs was coated over cotton cloth and subsequently evaluated for antimicrobial activity. Coated cotton surface exhibited promising (reduction more than 99.9% of viable microbes) anti-bacterial and anti-fungal activity against the two representative strains. In the next phase, we are planning for anti-viral activity of CT NPs impregnated cloth. Upon getting desirable anti-viral activity, it can be used to coat surfaces, cloths, PPE kits to limit the transmission of microbes including COVID-19.



4. Non-carbonated antacid preparation with GIT protective action

Prepared non-carbonated, monophasic antacid formulation at small scale and optimization studies are performed. Initial studies like Preliminary Antacid Test (PAT), Acid Neutralizing Capacity (ANC) and Buffering Capacity, are already performed using the optimized formulation. Based upon the results, it fulfils all requirements to be an antacid as per United State Pharmacopoeia (USP). In the next phase, we are trying to find collaborator to perform studies like physicochemical analysis, stability studies and its efficiency testing in simulated gastric fluid.

- **Amity Food & Agriculture foundation**

1. Ready to fry meatball

Paradigm shift in lifestyle has led to increased consumption of convenience ready to eat meat products. Various versions of meatballs are present as traditional cuisine across the world. In this study the effectiveness of gelatin extracted from Pink Perch skin and bones was assessed to improve rheological properties of chicken meatball. Meatball was prepared by incorporation of (3-6%) Pink Perch skin and bones gelatin. Deep fat fried meatball were analyzed for its proximate composition, functional properties and acceptability based on sensory

attributes. Addition of gelatin has significantly improved the textural and functional properties of meatball. Gelatin incorporated meatball had higher ($P < 0.05$) WHC than control. During TPA it was observed Gelatin meatball had comparatively lower hardness than control meatball and greater springiness and chewiness than control meatball.

2. Gelatin for fish skin and bones

Rapid growth of fish processing has resulted in increasing quantities of waste. It is estimated that fish processing waste after filleting accounts for approximately 75% of the total fish weight. Global fish waste is estimated to be approximately 100 mMT, and more than 4 mMT in India. These wastes are dumped, buried, used for landfilling, or incinerated, increasing environmental hazards, pollution, and threat to public health and increasing greenhouse gas emissions. These wastes are inexpensive sources of amino acids and protein, underlining their potential to be used as food, animal feed and fertilizer. The utilization of waste from fish processing industry for production of value-added products has attracted substantial attention. Gelatin was extracted from Pink Perch skin and bones biomass using RSM model. The produced gelatin was compared with commercial bovine gelatin with regard to some rheological and physico-chemical properties. Gelatin characterization showed acceptable rheological and functional properties compared to the commercial bovine gelatin. These results imply that the gelatin with good interfacial properties could potentially be used as a novel ingredient in food systems

3. Ready to Cook Protein Rich Soup Powder

In this modern era convenient food products are emerging objective of food processing industries. These food products include ready to cook and ready to eat/drink products. Soup is one of such value added food products that is made by blending ingredient such as meat, vegetables with various other ingredients. Fish are important source of animal protein and Omega-3-polyunsaturated fatty acids (EPA – eicosapentanoic acids and DHA-decosahexanoic acids) which has many health benefits. In this study Pink Perch (*Nemipterus japonicas*) head & viscera which are generated as by-products during surimi processing are used for extraction of protein hydrolysates through

enzymatic hydrolysis. The Pink Perch head & viscera protein hydrolysates are having moderate antioxidant activity and high essential amino acids content are further microencapsulated by using different wall material (maltodextrin, gum arabic, sodium alginates and carboxyl methyl cellulose) to lower the fishy odor of protein hydrolysates. The microencapsulated protein hydrolysates were used for preparation of Ready to Cook protein rich soup powder. The Ready to Cook protein rich soup powder was prepared by blending microencapsulated protein hydrolysates with vegetables. The Physio-chemical and sensory analysis of Ready to Cook soup powder was conducted and observed that microencapsulated soup powder contain approximately high amount of protein content with acceptable aroma. These Ready to Cook soup powder can be potential alternative food for the protein deficient peoples.

4. Bio-formulation

A liquid formulation of endophytic bacteria isolated from organic tomato seeds for crop protection and plant growth promotion was developed. 75 bacterial endophytes isolated from organic tomato seeds were screened for their bioactivity against *R. solani*. More than 95% endophytic bacteria suppressed the growth of *R. solani* in dual culture assay. *Bacillus siamensis* bacterial strain NKIT9 inhibited the growth of fungal mycelium of *R. solani* with $\geq 90\%$ inhibition percentage by producing bioactive metabolites (Surfactin and Bacillomycin D) and hydrolytic enzymes. The isolate was finally developed in to oil-in-water formulation. The present invention provides a composition comprising bioactive ingredients of microbial origin (bacterial endophyte). The composition is further distinguished by the fact that it is an oil-in-water micro-emulsion. The active ingredients in continuous phase are pure endophytic bacterial cells (e.g. *Bacillus siamensis* NKIT9) suspended in distilled water or fresh nutrient broth. The isolate is a potential plant protectant and growth promoter. However, the biological activity of the isolate if suspended in broth or water can be lost by the act of high temperatures; oxidation and UV light or simply gets contaminated. These disadvantages make the commercial application of bacterial cultures limited. Hence it is imperative to formulate microbial isolates into a stable water soluble liquid forms (emulsions, micelles etc.), intended to be employed for controlled release of active ingredients and protecting them from the external environment. Hence, in present invention, vegetable oil based oil in water

liquid formulation has been developed. This bio-formulation has enhanced the bioactivity against plant pathogens (*R. solani*) and shelf life of the *B. siamensis* NKIT9 at room temperature for 12 months ($\geq 10^7$ CFU/ml). Tomato seeds coated with the formulated isolate showed excellent germination (80-90%) as well as increased the survival rate to tomato seedlings and prevent the damping off disease up to $\geq 80\%$.

- **Amity Institute for Herbal Research & Studies (AIHRS)** has developed health care dietary supplements, as functional antioxidants to combat oxidative stress, cosmeceuticals, herbal hand sanitizer, floor cleaner, and insect repellent.

Scientifically validated for safety, efficacy and quality (Phytochemicals as markers, ingredients with GRAS safety level).

Adjuvant dietary supplement for bone health in Osteoporosis, Anti-mutagenic antioxidants, Anemia, malnutrition. Herbal Mosquito-Insect, Herbal Floor disinfectant, Herbal hand Sanitizer and Herbal Dish wash.

Common Prime Salient features:

- Eco-friendly, cost effective raw material even some of the phyto-pharmaceuticals are from agri-horticulture waste or agri-industrial waste.
- Scientifically validated process and product based on phytochemical markers.
- No bigger set up required possibility to set at very cost effective level.
- Nutraceuticals/functional foods as general health as preventive adjuvant supplements.
- May be helpful as dietary supplements to combat health problems and associated disorders.
- The development of next generation nutraceuticals products consists value-addition.



- Students of Amity Institute of Space Sciences & Technology has developed. Low cost, light weight, compact, Six Wheel Rover having the following features:
 - ✓ All terrain movement capability
 - ✓ All independent traction mechanism (i.e., all independent powered wheel)
 - ✓ Both push and pull mechanism suited for traction. Also, variable traction mechanism included depending on wheel for power saving
 - ✓ Zero turning radius (This enables the vehicle to turn 360° without moving from the spot)
 - ✓ Both Autonomous & manual control
 - ✓ Obstacle avoidance
 - ✓ Self-localization, tracking and mapping capability (*using HACTOR SLAM with 360° RPLIDAR*)
 - ✓ Environment sensing capability i.e., *image capturing, temperature, pressure, humidity sensing*



- Amity Business School with a vision of strengthening innovation, proposes to institutionalize **“Pratyahara - Department of Spirituality, Consciousness and Research”**. Understanding the fact that Education must nurture the holistic development of human beings, the Department will serve as a platform to explore and research the rich indigenous intellectual heritage for holistic understanding of Indian Civilization and to conduct interdisciplinary research. For coordinated synthesis of modern knowledge with the Vedic knowledge and create a world class center for study and research in the area of spiritual studies with its focus on Indian philosophy, arts, literature, culture, tradition and society apart from other academic endeavors. ABS as a Top ranked institution, the Department will serve as a medium to conduct Research, Trainings, Conferences, Workshops, EDP, MDP, Counselling, Consultancy and Ancillary Services in the area of Spirituality, Meditation, Yoga and Vedic Research with its Scientific Application and strategic partnering with similar premier institutions. Dr. Vijit Chaturvedi, Professor is the Head of **“Pratyahara - Department of Spirituality, Consciousness and Research”**.

b) AMITY UNIVERSITY CHHATTISGARH

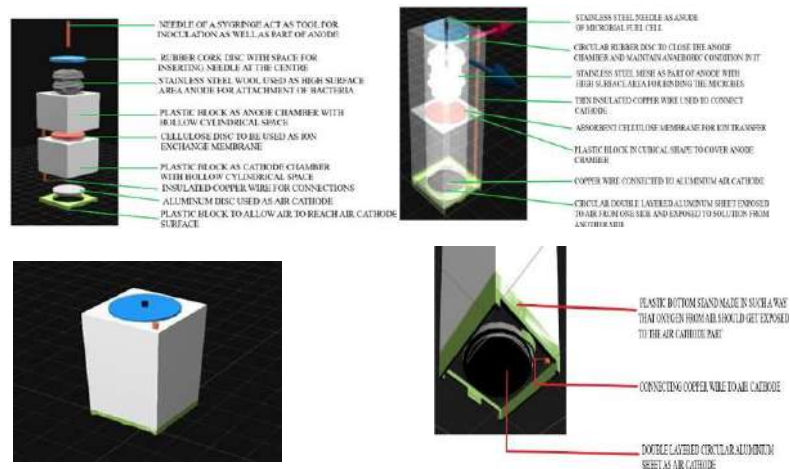
- **MICROBIAL FUEL CELL BASED ANTIBACTERIAL SCREENING 96 WELL PLATE DESIGN AND METHOD**

There are number of ayurvedic, herbal and pharmaceutical companies which develops versatile formulations against certain bacterial infections. But due to existing microbiology techniques it becomes a time-consuming process to study each formulation in different dilutions and dosage in multiple experiments. In addition to this, the very large size trial could not be implemented due to instrumentation and resource hurdles.

There are certain high-tech devices and instruments available these days, but they are so expensive that average pharma companies could not afford them. Hence, there was a need of such device which will be handy, affordable, easy to handle as well as extremely specific in its performance. This device solves all these hurdles. Around 96 compounds could be tested in a single plate in this device. Hence, all these hurdles are solved with this device.

Using this technology, pharmaceutical compounds could be accessed for its antibacterial activity against certain pathogenic bacteria in different concentrations

as well as dilutions. Around 96 compounds could be tested at the most against certain infectious bacteria using this invention. But it is always advisable to set some of the units in this 96 well plates as both positive and negative controls in the trails. So, on an average if 5 units are used for positive control with known and pre-established drug and 5 units are used for negative control with no pharmaceutical compound, then remaining 86 units could be used for experimental drug compounds. The voltage across each unit of MFC could be displayed using multimeter or voltmeter.



c) Amity University Rajasthan

- Zoom** is an idea which can help us reduce pollution while travelling for a short distance, this idea basically focus to provide a mode of transportation inside the campus it-self, as it is a basic problem for student to reach camps from hostel and to reach within time so to maintain the time and to be free from pollution we provide cycles stands and cycle by which any student just with a click on his/her device can just ride the cycle and reach their destination they don't even need a wallet to worry about the payment also as they can just top-up there app balance and can freely ride their bikes, and it very helpful in maintaining their health as we can see that the current youth also focuses on health and cycling can be an effective way to maintain our body and health and can stay away from Covid-19 viruses.

- Online Coolie Service – Uthalo**

While Travelling on Trains, we all have been there, We have so much luggage but unable to find a coolie. It not only causes an hassle but is also time consuming and in some circumstances can even lead to missing the train after all. We have come up with the innovative idea to integrate the existing coolie service and give a modern twist to it. We will be providing an app where the coolies can register and they can accept customers request in real time. This will easily connect a customer to the coolie and with the implementation of real time location tracking navigating within the Station and finding the correct meeting point will create less confusion. Uthalo is basically an interface connecting the service provider with the customers while also accepting the current standards of the “coolie industry”.



- Frying Pan** a.k.a Foods Day Out (FDO) is a food truck startup with motto of “Five Star Delicacy on your Plate” provides customized menu for student and at your door order facility. FDO provides a large number of menu selection with quantity and quality food to fulfill you craving. FDO menu includes sandwiches, pizza to combo and meals. Not just stopping at food items, we also provide a good range of beverages to complete your hunger. With at your door facility people get their food without moving from their place. FDO offers affordable items with better quantity.

- **Gym trainers** is a platform that offers personal training with gym membership. It was started by Nikhil Pawar on 1 April 2020 with a vision to make personal training in gym accessible for the youth which have been to gym but never achieved their goals. Gym trainers is incubated at IIM Kashipur & recognized by startup India and we have worked in countries with some of the most prominent brands like Times of India & naturaltein. With our 1:1 model we aim to provide low cost and protein free alternatives for everyone that is both reliable and low- cost

d) Amity University Punjab

a. Development of Enzyme Technology for Second generation biofuel industry by Dr Anmoldeep Randhawa

- **Development of modern biotechnological tools to engineer a promising fungus, *Penicillium funiculosum* NCIM1228:** wherein the scientist developed vectors; optimized Agrobacterium-mediated transformation as well as CRISPR/Cas9 genome editing methods; and selection process of transformants. It was found that drug tolerance is the major hindrance towards selection of the transformants. Through transcriptomics, we identified major classes of drug efflux transporters in the fungi responsible for drug tolerance and carefully developed a selection medium that specifically inhibit drug tolerance without affecting transporters involved in nutrient uptake. The optimization resulted in zero false positives during transformation process. The tools and techniques developed were also applicable to other yeast, fungi as well as algal systems.
- **Removing Negative regulation of cellulase expression:** Using molecular approaches and -Omics studies, the scientist identified mechanism of negative regulation in filamentous fungi and deleted key proteins, Mig1 and Mig3 to achieve 2-fold higher cellulase production.
- **Strengthening transcriptional activation mechanisms of cellulase:** Known transcriptional activators were identified, over-expressed and screened to identify the most significant, ClrB. ClrB was then expressed under three different promoters and best effect was achieved with a strong constitutive promoter.
- **Strengthening cellulase secretions mechanisms:** Signaling pathway governing cellulase translation and secretion were identified. Using molecular and bio-chemical approaches, she identified and over-expressed key serine-threonine kinases specifically governing the cellulase translation and secretion.

b) Development of one step detection kit for organophosphates by Dr Vishal Aggarwal)

Indiscriminate use of pesticides has contaminated our water bodies and food. Studies have shown that persistent exposure to pesticides can lead to their accumulation in the tissues and induce harmful effects on fetal growth, skin, reproductive system etc. The team have developed a simple and easy-to-use, single-step detection kit to detect the presence of various pesticides (organophosphates) in water samples. The kit has a glass slide with depression. Application of a few drops of contaminated water will result in the formation of a precipitate. The kit is simple, can be used by anyone, is field deployable (does not require any instrument to read/interpret the results, and is inexpensive.

c) Manufacturing of Photocatalytic Geopolymer bricks, tiles and biochar using waste sludge and manufacture by Dr Pratap Reddy

II : RESEARCH CENTERS & CENTERS OF EXCELLENCE

Amity University has also established research centers & Centers of Excellence in niche areas to provide impetus to research activities. The campus wise list of such centers is shared below: -

➤ **Research centers at Amity**

a) Amity University Uttar Pradesh Noida

- Amity Food & Agriculture Foundation
- Amity International Centre for Post-Harvest Technology & Cold Chain Management, (AICPHT& CCM)
- Amity Center for Bio Control & Plant Disease Management (ACBPDM)
- Amity Institute of Herbal Research & Studies (AIHRS)
- Amity Center for Extension Services (ACES) (Agriculture)
- Amity Center for Soil Sciences (ACSS)
- Amity Center for Carbohydrate Research (ACCR)
- Amity Center for Spintronic Materials (ACSM)
- Amity Center for Astronomy and Astrophysics (ACAA)
- Amity Society for Nuclear Security
- Sir Richard Robert Center for Genetically Modified Organism
- Amity Institute of Click Chemistry Research and Studies (AICCRS)
- Amity Institute of Water Technology and Management
- Amity Center for Antarctic Research & Studies
- Amity Center for Environmental Health and Sciences
- Amity Mega Center for Natural and Man-Made Calamities
- Amity Centre for Inter-Disciplinary Research (ACIDR)
- Amity CIMA Centre of Excellence
- Centre for VUCA Studies (CVS)
- Amity Centre for Yoga Education, Therapy and Research (ACYTER)
- Amity Centre for Cancer Epidemiology & Cancer Research
- Amity Institute of Indian System of Medicine (AIISM)
- Amity Institute of Genome Engineering (AIGE)

Amity University Haryana

- Centre for Financial Analytics
- Centre for Capacity Building in the Field of Higher Education
- Centre for Robotics
- Centre for Ocean-Atmospheric Science and Technology
- Centre for Linguistic Studies
- Center For Data Science and Computational Biology
- Centre For Nanotechnology
- Centre for Medicinal Plants and Traditional Knowledge
- Center For Air Pollution Control
- Kiran Majumdar Shaw Centre for Affordable Innovation Center
- Centre for BRICS Studies
- Nobel Laureate Kailash Satyarthi Centre for Child Rights & Development
- AYUSH-Amity Herbal Garden and Medicinal Plants Distribution Centre
- Centre for Drug Design and Discovery

c) Amity University Rajasthan

- Amity Centre for Water Studies and Research
- Amity Centre for Ocean Atmospheric Science and Technology
- Amity Interdisciplinary Centre for Climate Research and Policy

d) Amity University Madhya Pradesh

- Centre for Environmental Conservation & Biodiversity Of Madhya Pradesh
- Centre for Detection of Fake News and Disinformation

e) AUUP Lucknow Campus

- Centre for Media Studies
- Centre for Cyber Forensics and information Security

f) Amity University Chhattisgarh

- Centre for Nanoscience & Nanotechnology

g) Amity University Mumbai

- Centre for Computational Biology & Translational Research (CCBTR)

➤ **Centres of Excellence**

a) Amity University Uttar Pradesh Noida

- NRDC-Amity Innovation Facilitation Centre
- Amity Center for Entrepreneurship Development
- Quanser Qube Laboratory
- DST- Technology Enabling Center (TEC)

b) Amity University Haryana

- Center of Excellence for Bioenergy and Biofuels
- Centre of Excellence in Indic and Sanskrit Studies
- Amity-GE Health care Centre of Excellence

c) Amity University Madhya Pradesh

- Centre of Excellence for Chemical, Biological, Radiological and Nuclear (CBRN) Mitigation
- Centre of Excellence for Nano-biotechnology and Alternative Medicine
- Centre of Excellence for Environmental Conservation & Biodiversity
- Gwalior as a Smart City
- Centre of Excellences for Detection of Fake News and Disinformation

d) Amity University Lucknow campus

- Centre of Excellence for Research-Driven Media Activities in Financial Risk Management and Data Analytics
- Centre of Excellence for Photonics and optoelectronics

e) Amity University Chhattisgarh

- Center of Excellence on Gender Studies supported by UNICEF
- Center of Excellence on Ayurveda, in association with AIIMS, Raipur
Established in 2020
- Center of Excellence on Robotics Process of Automation, In association with Automation Anywhere Inc. USA & UiPath
- Center of Excellence on Tribal Development
- Center of Excellence on IPR

f) Amity University Mumbai

- Amity Centre of Excellence in Astrobiology

III: RESEARCH & INITIATIVES IN CONNECTION WITH COVID – 19

1) Technologies developed

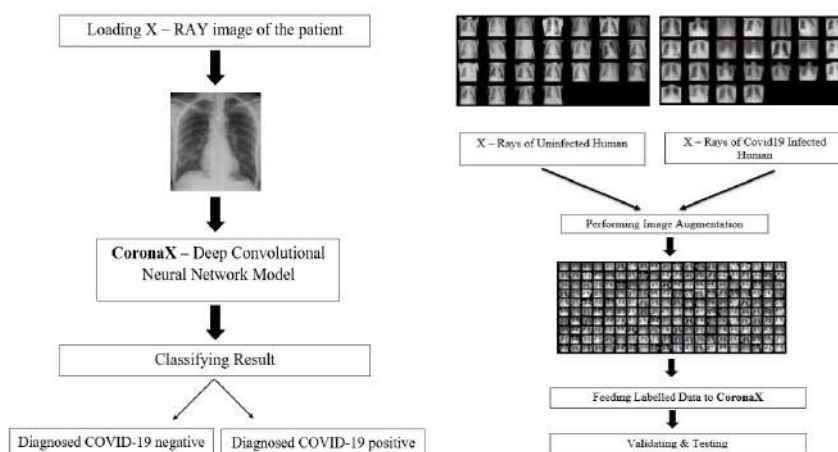
Amity University Noida

- **Novel anti-microbial coating formulation**

Amity Institute of Phytochemistry and Phytomedicine has developed anti-microbial coating formulation wherein Copper-tannic acid nanoparticles (CT NPs) were prepared with economic and scalable process. The characterization of CT NPs using XRD, SEM, FT-IR and TGA revealed its nano size with desirable features. Special coating ink prepared using the CT NPs was coated over cotton cloth and subsequently evaluated for antimicrobial activity. Coated cotton surface exhibited promising (reduction more than 99.9% of viable microbes) anti-bacterial and anti-fungal activity against the two representative strains. In the next phase, we are planning for anti-viral activity of CT NPs impregnated cloth. Upon getting desirable anti-viral activity, it can be used to coat surfaces, cloths, PPE kits to limit the transmission of microbes including COVID-19.

- **CoronaX - A Deep Convolutional Neural Network Model for Reliable Detection of SARS- Related Coronavirus (COVID-19)**

A new virus affecting the respiratory system of humans and animals called the novel coronavirus made the headlines for triggering an outbreak of the breathing illness worldwide in 2019. It spread throughout the world in a very short span of time, affecting people on a large scale and causing thousands of deaths which is a major challenge for healthcare professionals. In the present scenario, Ms. Ishika Dhall and Mr. Shubham Vashisth (STUDENTS) of Computer Science Department, Amity University Noida under guidance of their faculty Dr Shipra Saraswat have developed a novel method of designing a real time system for efficiently diagnosing COVID-19 to keep a precise record of positive cases so that people who are diagnosed positive can be treated on time and can be prevented from being a carrier of the virus being transmitted to more people with a testing accuracy of more than 90%. The AI based method provides real time system for efficient and reliable detection method for efficiently diagnosing SARS-related coronavirus and keeps a precise record of positive cases so that people can be treated timely and community spread can be prevented



WORKING OF CORONA X Construction of CoronaX

- **Herbal Hand Sanitizer**

An effective and highly useful Hand sanitizer made from herbal extracts has been developed by Dr. Seema Bhatnagar & Dr. V. Pooja from Amity Institute of Biotechnology, Amity University Noida which has proven anti-microbial property and is safe for use in people of all age groups. The hand sanitizer is broad spectrum (effective against bacteria fungi, virus) comprising of herbal extracts having proven efficacy against a wide variety of opportunistic hospital/ airborne pathogens. These extracts have been tested against Streptococcus spps, Staphylococcus aureus, E. coli, Bacillus subtilis, Pseudomonas spps, Candida albicans, Aspergillus niger and Cryptococcus neoformans. The combined effect of herbal extracts formulated in water base provides broad spectrum anti-microbial potential to the sanitizer. The product has long term shelf life and retains its efficacy is suitable for patients, frontline health professionals as well as for general public.



Hand sanitizer developed by Amity

- **Nano based herbal inhaler**

Developed by Dr. Dhruv Kumar, Amity Institute of Molecular medicine and stem cell research, Amity University Noida. The anti-viral herbal inhaler comprising of Nano-gold based herbal nasal cream formulation has been prepared with the herbs known for their

medicinal value, The inhaler effectively inhibits the infection and propagation of SARS-CoV-2 through nasal air flow.

- **PORTABLE VENTILATOR SYSTEM WITH VARIOUS SENSING MODES**



A portable ventilator system with various sensing modes have been designed by a team of brilliant researchers from Amity University Noida. The ventilator system can record all the parameters has an in-built IoT device which can send the data with information of date and time on the server continuously thereby providing real-time information of the patient's vital parameters. The salient features of the instrument includes:-

- Volume and pressure adjustment according to age: Automatic adjustment of breathing according to age.
- Can set number of Breathing per minute
- Can control volume, pressure, temperature, and humidity
- Auto mode to enable the feature for ideal situation.
- Auto mode with oximetry and heartbeat sensor
- Purification of Exhaled gases

- **A SYSTEM FOR DETECTION OF CORONAVIRUS AND THE LIKE BODY SYMPTOMS**

Prof. Ashish Mani from Amity School of Engineering & Technology has developed a device for disinfecting the currency, which is implemented for the perfect solution for the banks and high transaction places. The device includes a real-time screening of Covid19 patients using multi-factor sensing including X-Ray imaging, Thermal monitoring and Video Analysis. The suitably positioned X-Ray machine interfaced with Artificial Intelligent based interface screening system, which receives precise X-Ray images, Thermal Images and Videos in real time, processes and classifies in real-time with very high accuracy. It can be installed at entry points of places of Mass gatherings like Universities, Malls, Metro Stations and Airport etc. The system will allow entry to persons only if the multifactor sensing clears that individual on all factors and this is achieved with intelligent decision making. It would be equipped with facial recognition biometrics and card / mobile based identifier and will inform the condition on a centralized database for reporting to various stake holders about suspected cases.

- **FLOOR DISINFECTANT**

Dr. Seema Bhatnagar & Dr. V.Pooja have developed a floor disinfectant that cleans and deodorize floor surface, removes dirt, disinfects, deodorizes and kills the pathogenic microorganisms, removes greasy and tough stains on floors and tiles that keep away flies and insects. Floor disinfectant is suitable for wet mopping and restroom surface cleaning. However, with little variation in the dilutions of concentration of active ingredients according to the requirement/demand of disinfectant application. It is suitable for large area sanitization and sterilization for surfaces like glass, ceramic, wood, textile, etc.



In-vitro antimicrobial Test Results

- **Covid-19 kit, with ‘smart’ gloves, wearables**

To protect people from Covid-19, Dr. V.K Jain have led a team of students to come up with a handy low-cost and low-powered battery operated kit that contains an electronic smart device for maintaining social distancing, smart gloves with a self-sanitising system, and an electronic device to keep one’s hands away from the face. the kit would cost about Rs 500. The electronic smart device helps the user maintain a social distance of six feet from others. It has a buzzer and a light alarm and it warns the user if the six feet distance is breached. The radio frequency based device can be worn as a wrist band and has chargeable batteries.

The gloves in the kit will not only protect the wearer, but also prevent the spread of the coronavirus disease owing to its special design. The inner layer is the same as that of a normal glove followed by second layer consisting of a special material loaded with antiviral agents, sanitiser and disinfectant. The topmost layer is perforated to release the antiviral agent to the surface which will kill the virus and prevent its spread. The sanitiser is released automatically by the movement of fingers when they hold an object. In Addition, to prevent the most common habit of touching one’s face, they have also created an automatic alarm device. This wearable low-cost and low-powered battery operated device will support individuals in building positive habits. It would emit an alarm each time a user tries to touch their face. This gadget is very affordable, lightweight and can be worn around the neck like a pendant. It has a buzzer alarm, a LED light and vibrator and the alert that will become stronger as the hand gets closer to the face.

- **RNA extraction free assay for kit development to visually diagnose COVID-19**
Amity Institute of Biotechnology, **Amity University Haryana**

SARS-CoV-2, the causative agent for COVID-19 pandemic, continues to wreak havoc across the globe leading to unimaginable loss of human lives and plunging millions into extreme poverty. This evocative scenario of COVID-19 pandemic has presented a formidable defiance even for most sophisticated hospital settings. There is an urgency to develop simple, fast and highly accurate methods for the rapid identification and isolation of SARS-CoV-2 infected patients.

In an effort to address the ongoing challenge, the present study offers a CLEVER assay (CRISPR-Cas integrated RT-LAMP Easy, Visual and Extraction-free RNA) which will allow RNA extraction-free method to visually diagnose COVID-19. RNA extraction is a major hurdle in preventing rapid and large-scale screening of samples particularly in low resource regions because of the logistics and costs involved. Herein, the visual SARS-CoV-2 detection method consists of RNA extraction-free method directly utilizing the patient nasopharyngeal and oropharyngeal samples for reverse transcription loop mediated isothermal amplification (RT-LAMP). Additionally, the assay also utilizes the integration of CRISPR-Cas based system using different guide RNAs of N and E genes along with visual detection via lateral flow readout based dip sticks with unaided eye (~100 min). Together, our CLEVER assay offers a point-of-care tool with no equipment dependency and minimum technical expertise requirement for COVID-19 diagnosis.

- **N95 mask by using 3D printing technology**
Amity Centre of Nanotechnology, **Amity University Haryana**

Reusable, Recyclable, Washable, Odorless, Non-Allergic, and Anti-Microbial. The outer layer of the mask is made up of Silicon which has a shelf life of more than 5 years depending upon use. A 4-layer filtration mechanism has been provided in the mask by four different layers. The outer and first layer of the filter is coated with Nanoparticles, the second layer is HEPA filter, third layer is 100 µm filter and fourth layer is moisture absorbent filter. **The mask is being named as nanoBreath and first trademark of Amity University Haryana has also been registered for the same. A patent on the same has also been filed.**

- **COVID-19 Rapid Antibody Screening Kit**
Amity Institution Microbial Technology, **Amity University Rajasthan**

Lateral flow-based kit for rapid antibody-based diagnosis of COVID-19 has been developed utilizing chimera protein covering immunodominant epitopes of four major antigens SARS-CoV-2 virus. This chimera protein has been designed and developed by our own lab. The kit is developed in collaboration with Genomix CARL Pvt. Ltd., Pulivendulla, and has got approval for Govt. of India's Test License and is presently under clinical validation with the company.