ABSTRACT BOOK

3rd INTERNATIONAL CONFERENCE ON BIOSCIENCE AND BIOTECHNOLOGY (ICBB 2020)

"EXPANDING NEPAL'S BIOTECH HORIZON"

POKHARA, NEPAL

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icbb2020

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CREATIVE HEAD

AAGAT AWASTHI

Nepal

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3rd International Conference on Bioscience and Biotechnology

(ICBB2020)

Theme: Expanding Nepal's Biotech Horizon

January 28 – 31, 2020 | Pokhara, Nepal

Day 1, January 28

10:00 – 14:00	City Walk / Fewa Lake boating	Lakeside, Pokhara
14:00 – 15:00	Conference Setup / Registration (International)	Hotel Barahi, Pokhara
15:00 – 18:00	Introduction, Interaction & Scientific Discussion 1) Meeting about University of Nepal (Proposed) by Prof. Arjun Karki, HAMS, Nepal. (60 min) 2) Meeting about Nepal Research Alliance (NRA) by Dr. Ashim Dhakal, Phutung Research Institute, Nepal (60 min) 3) Meeting about ongoing research activities at RIBB by Mr. Prajwal Rajbhandari, RIBB, Nepal (60 min)	Hotel Barahi, Pokhara
18:30 Onwards	Welcome Reception	Hotel Barahi, Pokhara

Day 2, January 29

08:30 – 09:30	Registration (National) / Tea - Coffee	Remarks
09:30 – 10:25	Welcome & Inauguration (5 min) Ms. Manisha Bista Master of Ceremony	Center for Molecular Dynamics Nepal (CMDN), Nepal
	Welcome Remark by Host & Organizer Mr. Prajwal Rajbhandari, President Chair, ICBB2020 (10 min) Launching of RIBB profile video (5 min)	Research Institute for Bioscience and Biotechnology (RIBB), Kathmandu, Nepal.
	Remark I: Dr. Ashim Dhakal (5 min) Showcasing NRA profile video (5 min)	Nepal Research Alliance (NRA), Nepal
	Remark II: Prof. Arjun Karki (5 min)	Hospital for Advance Medicine and Surgery (HAMS), Nepal
	Remark III: Mr. Ganesh Shah, Former Minister (5 min)	Ministry of Science, Technology & Environment, Government of Nepal
	Remark by Chief Guest: Dr. Sunil Babu Shrestha, Vice Chancellor (10 min)	Nepal Academy of Science and Technology (NAST), Nepal
	Vote of Thanks: Ms. Manisha Bista (5 min)	Center for Molecular Dynamics Nepal (CMDN), Nepal

10:30 – 10:55	Keynote Speech I: Mr. Rob van Daalen, Publisher, Elsevier, the Netherland	
SESSION I	GREEN & SUSTAINABLE CHEMISTRY Chair: Prof. Janardan Lamichhane, Kathmandu University, Nepal Co-Chair: Dr. Prativa Pandey, RIBB, Nepal	
10:55 – 11:15	Speaker 1 – Prof. Sanong Ekgasit	Chulalongkorn University, Thailand
11:15 – 11:35	Speaker 2 – Dr. Michele Iafisco	Istituto di Scienza e Tecnologia deiMateriali Ceramici (ISTEC) - CNR, Italy
11:35 – 11:55	Speaker 3 – Dr. Ramesh Pd. Pandey	Sun Moon University, Republic of Korea
11:55 – 12:15	Speaker 4 – Dr. Alessio Adamiano	Istituto di Scienza e Tecnologia deiMateriali Ceramici (ISTEC) - CNR, Italy
12:15 – 12:35	Speaker 5 – Mr. Parinton Jangtawee	Chulalongkorn University, Thailand
12:35 – 14:00	Poster Session / Stall Exhibition & Lunch	

SESSION II	MEDICAL & PHARMACEUTICAL SCIENCES Chair: Prof. Shishir Gokhale, Head, Dept. of Microbiology, Manipal College of Medical Sciences, Pokhara, Nepal Co-Chair: Dr. Prson Gautam, FIMM, University of Helsinki, Finland	
14:00 – 14:20	Speaker 6 – Prof. Krzysztof Fujarewicz	Silesian University of Technology, Gliwice, Poland
14:20 – 14:40	Speaker 7 – Dr. Suraj Bhattarai	Global Institute for Interdisciplinary Studies (GIIS), Nepal
14:40 – 15:00	Speaker 8 – Dr. Alba Abad Fernandez	Wellcome Centre for Cell Biology, University of Edinburgh, UK
15:00 – 15:20	Speaker 9 – Dr. Roman Jaksik	Silesian University of Technology, Gliwice, Poland
15:20 – 15:50	Coffee Break	
15:50 – 16:10	Speaker 10 – Dr. Prabhat Bhusal	University of Otago, Dunedin, New Zealand
16:10 – 16:30	Speaker 11 – Dr. Basant Giri	Kathmandu Institute of Applied Science (KIAS), Nepal
16:30 – 16:50	Speaker 12 – Mr. Niraj Aryal	University of Tubingen, Germany
16:50 – 17:10	Speaker 13 – Dr. Ajit Kumar Karna	Center for Health and Disease Studies – Nepal (CHDS), Nepal
17:30 – 19:00	Sightseeing walk to Lakeside	
19:30 onwards	Dinner	Byanjan Restaurant, Lakeside

Day 3, January 30

09:00 – 09:25	Keynote Speech II: Prof. Remco Kort, VU University, the Netherland	
SESSION III	FOOD TECHNOLOGY & APPLIED MICROBIOLOGY Chair: Prof. Remco Kort, VU University, the Netherland Co-Chair: Prof. Bishnu Raj Tiwari, Pokhara University, Nepal	
09:30 – 09:50	Speaker 14 – Dr. Sergey Mikhaylin	Department of Food Science, Laval University, Canada
09:50 – 10:10	Speaker 15 – Dr. Namrata Karki Kandel	Ortho Molecular Products, Wisconsin, USA
10:10 – 10:30	Speaker 16 – Dr. Alice Marciniak	Department of Food Science, Ohio State University, USA
10:30 – 11:00	Coffee Break	
11:00 – 11:20	Speaker 17 – Dr. Denise Felix da Silva	Department of Food Science, University of Copenhagen, Denmark
11:20 – 11:40	Speaker 18 – Dr. Shyam Suwal	Arla Innovation Center, Arla Foods, Aarhus, Denmark
11:40 – 12:00	Speaker 19 – Dr. Santosh Koirala	University of Illinois, USA
12:00 – 13:30	Poster Session / Stall Exhibition & Lunch	

13:30 – 13:45	Guest Speaker: Willem Grimminck, Managing Director, One to Watch Nepal	
SESSION IV	AGRICULTURE & PLANT BIOTECHNOLOGY Chair: Dr. Bibek Aryal, Umea Plant Science Center, SLU, Sweden Co-Chair: Dr. Namaraj Dhami, Pokhara University, Pokhara, Nepal	
13:45 – 14:05	Speaker 20 – Dr. Bibek Aryal	Umea Plant Science Center, SLU, Sweden
14:05 – 14:25	Speaker 21 – Dr. Prakash M. Pradhanang	Lipman Family Farm, USA
14:25 – 14:45	Speaker 22 – Mr. Ashok Bhattarai	Praramva Biotech, Nepal
14:45 – 15:05	Speaker 23 – Mr. Manish Baral	Research Institute for Bioscience and Biotechnology (RIBB), Nepal
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15:35 – 15:55	Speaker 24 – Mr. Prabesh Shrestha	Sarba Shrestha Seeds, Nepal
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Day 4, January 31

Workshop I Mr. Rob van Daalen, Publisher, Elsevier, Amsterdam, the Netherland		
09:00 – 12:00	WORKSHOP ON "How to Publish High Quality Papers and Understanding Researcher and Publishing Ethics"	Pokhara University, Pokhara
12:00 – 13:00	Lunch	Pokhara University, Pokhara
14:00 – 16:00	WORKSHOP ON "How to Publish High Quality Papers and Understanding Researcher and Publishing Ethics"	Prithivi Narayan Campus, Pokhara

Workshop II 1) Ms. Suvechhya Bastola, Public Engagement Manager, RIBB, Nepal 2) Mr. Parinton Jangtawee, CEO and Co-founder, CU SmartLens, Thailand 3) Dr. Alba Abad Fernandez, Wellcome Centre for Cell Biology, University of Edinburgh, UK 4) Mr. Anil Gautam, Foldscope Nepal, Nepal		
10:00 – 13:00	WORKSHOP ON "Public Engagement Program at School"	Hill Point Higher Secondary School, Pokhara
13:00 – 14:00	Lunch	
14:00 – 16:00	WORKSHOP ON "Public Engagement Program at School"	Hill Point Higher Secondary School, Pokhara
10:00 – 16:00	Pokhara City Tour	International Participants only
18:30 Onwards	Closing Dinner & Nepali Cultural Show	Mount Glory Forest Resort, Pokhara

ORGANIZER:
Research Institute for Bioscience and Biotechnology (RIBB), Nepal
Conference Secretariat:
Research Institute for Bioscience and Biotechnology (RIBB), Nepal

Corporate Office
Ekantakuna - Tikabhairab Road, Lalitpur, Nepal
Phone: +977 9841171363 (Mitesh), +977 9841804369 (Prajwal)
Email: info@icbb.com.np, info@ribb.org.np

Session I

GREEN & SUSTAINABLE CHEMISTRY

Abstract Book
ICBB 2020

:

Chair: Session I
Green and Sustainable Chemistry

Biography: Professor Janardan Lamichhane

Prof. Lamichhane is an academician at Nepal Academy of Science and Technology (NAST) and Professor at Department of Biotechnology, Kathmandu University (KU). He has joined Department of Chemistry, KU as a lecturer in 1993 and completed his PhD in Biochemistry from Sun Moon University, South Korea in 2006. He has served as Founding President of Research Institute for Bioscience and Biotechnology (RIBB) for 6 and half years from July 2011 to December 2017. Currently he is serving as Chief Strategic Advisor at the institute.

Co-Chair: Session I
Green and Sustainable Chemistry

Biography: Dr. Prativa Pandey

Dr. Prativa Pandey is a researcher in the department biodiversity and natural product at RIBB. She is also a founder of Catalyst Technology, a S&T research consulting firm. She is a recipient of prestigious OWSD Early Career Fellowship 2019 to conduct research in valorization of citrus fruits in Nepal. She has a decade of research and industrial experiences, including international publications and US patents. She completed her Ph.D. in Chemistry from Northwestern University (US), Management Certificate from Kellogg School of Management (US), and B.S. Honors in Chemistry from Salem College (US).

Currently, her research is focused on the value addition of Medicinal and Aromatic Plants (MAPS) of Nepal. She has also founded a Natural Skincare Company, Herveda

Botanicals, based on 4 years of research on relevant MAPs and indigenous knowledge in Nepal. She is actively engaged in Science advocacy by supporting Science and Technology policy dialogues, mentoring students and professionals in STEM, participating in panel discussions, and as an advisor in related organizations.

Keynote Speaker - 01

Biography: Rob van Daalen

Rob van Daalen studied Analytical Chemistry and soon after his study he joined Elsevier. Since eight years he is publisher after holding various other positions within Elsevier. He is responsible for a portfolio of 12 journals in the field of Physical, Theoretical and Green Chemistry, which includes *Chemical Physics Letters and the Journal of Colloid and Interface Science and Current Opinion in Green and Sustainable Chemistry.* He is the initiator of the Green and Sustainable Chemistry Challenge (for which innovative green chemistry ideas that can be directly applied to local communities are invited) and the Green and Sustainable Chemistry Conference. Both the Challenge and the Conference are organized on a yearly basis and are in its 5th edition in 2020.

Green Chemistry And Sustainability Developments In Science And Publishing [KN 01]

Rob van Daalen

Senior Publisher Green, Physical and Computational Chemistry,
Elsevier, Amsterdam, The Netherlands.

Corresponding E-mail: g.daalen@elsevier.com

Abstract:

As the world's population edges towards 9 billion, the strain on the planet's resources is steadily increasing. There is a growing demand for food, manufactured goods and improved access to clean water and fuel. Green and sustainable chemistry has emerged as a critical discipline playing an essential role in tackling issues spanning energy, medicine, food & water, construction, transport, manufactured goods, and climate. An overview will be given of rapid developments in green and sustainable chemistry in science and in publishing.

Keywords: Green chemistry, Research analysis, Sustainable chemistry, UN SDGs

Biography: Professor Sanong Ekgasit

Sanong Ekgasit received his B.Sc. in chemistry (1989), M.Eng. in polymer technology (1992) from Chulalongkorn University, Thailand, and Ph.D. in polymer science and engineering (1996) from Case Western Reserve University, USA. He has been working at Department of Chemistry, Faculty of Science, Chulalongkorn University since 1999. His research interests include molecular spectroscopy, nanomaterials (synthesis, modification, and commercialization), amorphous and crystalline nanocellulose (synthesis and applications), and Lab-on-Phone researches.

Zinc Oxide Quantum Dot/Cellulose Nanocrystal Hybrid Structure As A Security Marker [OP 01]

Sanong Ekgasit[1,2,*], Umphan Ngoensawat[1], Attasith Parnsubsakul[1,2], Supakpong Kaitphaiboonwet[1], Tuksadon Wutikhun[3], Chaweewan Sapcharoenkun[3]

[1]Sensor Research Unit, Department of Chemistry, Faculty of Science, Chulalongkorn University, 254 Phaya Thai Road, Pathum Wan, Bangkok 10330, Thailand

[2]Research Network NANOTEC-CU on Advanced Structural and Functional Nanomaterials, Faculty of Science, Chulalongkorn University, 254 Phaya Thai Road, Pathum Wan, Bangkok 10330 Thailand

[3]ational Nanotechnology Center (NANOTEC), National Science and Technology Development Agency (NSTDA), Pathum Thani 12120, Thailand

***Corresponding E-mail:** sanong.e@chula.ac.th

Abstract:

Semiconductor quantum dots exhibit great potentials as fluorescence probes for security marker, optical imaging, and medical diagnostic. In general, the semiconductor quantum dot is synthesized from cadmium and lead derivatives which are toxic to human, living organisms, and environment. Due to the toxicity concern, we have investigated a biocompatible, environmentally friendly and non-toxic zinc oxide quantum dot/cellulose nanocrystal (ZnO QD/BCNC) hybrid structure for using as fluorescence probe (in this case as a security marker). In this work, bacterial cellulose nanocrystal (BCNC) with an average length of ~500 nm was prepared by sulfuric acid hydrolysis of bacterial cellulose pellicle. BCNC with abundant hydroxyl and sulfate ester groups was employed as a carrier for ~8-nm ZnO QD. After embedded ZnO QD on the BCNC surface, the optical property of ZnO QD was unchanged. The synthesized-ZnO QD was surface-functionalized with (3-Aminopropyl) triethoxysilane in order to create a strong electrostatic interaction with the surface of BCNC. When the ~8-nm ZnO QD was excited by a UV light with 360 nm, it emitted luminescence at 543 nm. The nanohybrid structure can attach securely on the surface of cellulose-based materials (i.e., bank notes, lotteries, checks, and cotton fabrics), even after boiling in water and scratching. Since it is invisible to the naked eye, it expressed a great potential as a security marker.

Keywords: Nanocrystals, Semiconductor, ZnO

Biography: Dr. Michele Iafisco

Michele Iafisco is senior researcher at Institute of Science and Technology for Ceramics (ISTEC) of the National Research Council (CNR) in Faenza (RA), Italy since 2013. He graduated in Chemistry in 2005 from the University of Bologna. From the same university he obtained the Ph.D. degree in Chemical Science in April 2009. His research interests include biomaterials, biomineralization, nanotechnology, and bioceramics. He has authored more than 90 papers in international peer-reviewed journals, 15 book chapters and 6 patents. H-index=31, total citation: more than 2800, Source: Google Scholar (November 2019). He is member of the editorial boards of several international journals and expert evaluator for the European Commission and for other European research agencies. In 2015 he was recipient of the prize “Ricercatamente 2014” for the best research activity of most promising young researcher “under 35” at the National Research Council of Italy in the field “Chemical Sciences and Materials Technology” and of the IUPAC-2015 Young Chemist Travel Award. He is scientific responsible of the Research Line on “Nanostructured materials for dental and maxillofacial applications” of the ISTEC-CNR.

From Nanomedicine To Nanofertilizers - New Perspectives In The Use Of Nanotechnology For Agriculture. [OP 02]

Michele Iafisco

Institute of Science and Technology for Ceramics (ISTEC), National Research Council (CNR) Via Granarolo 64, 48018 – Faenza (RA), Italy

Corresponding E-mail: michele.iafisco@istec.cnr.it

Abstract:

The current agriculture model is based on a progressive expansion of arable lands and increased input of energy, fertilizers, pesticides, and water. The Nutrient Use Efficiency (NUE) is the relationship between the amount of nutrients acquired by plants and the resulting production of biomass. Due to soil physicochemical properties, and to the characteristics of most used fertilizers, the NUE for macronutrients in crops is lower than 50%. For this reason, the intensive cultivation of crops has unsustainable financial and environmental costs.

Nanotechnology offers the potential for improved plant nutrition assisting the development of precision agriculture, whose main aims are to avoid nutrient losses by synchronizing the release of nutrients with crops uptake. Currently, the development and utilization of the potential of nanotechnologies in crop fertilization is a high priority in the search of new and more efficient fertilizers. However, the deliberate introduction of nano-sized materials within agricultural activities rightly raises questions and expresses concern over the possible human and environmental health implications, since nanomaterial residues in soils and crops are expected to increase with exposure routes including possible bioaccumulation in the environment and food chain. In this view, the resort to biomaterials used for nanomedicine and drug delivery could help answering the request for biologically-safe and environmentally-friendly nanoparticles. For example, recently, hydroxyapatite nanoparticles which are renowned for their excellent biocompatibility and bioactivity in several medical fields – e.g., bone tissue engineering, intracellular drug delivery and gene delivery – have been advocated as a promising P nanofertilizers.

In this talk I will discuss the most recent advancements of nanotechnology applied to agriculture, highlighting how our knowledge on the development and use of nanomaterials for medical applications can help to increase the delivery of nutrients to plants and decrease the health concerns.

Keywords: Hydroxypatite, Nanomedicine, Nanofertilizers

Biography: Dr. Ramesh Prasad Pandey

Ramesh Prasad Pandey (Syangja, Nepal, 1984) is an Assistant Professor at Department of Pharmaceutical Engineering and Biotechnology, Sun Moon University, South Korea. Dr. Pandey accomplished his M. S. (Microbiology) at Kurukshetra University, Haryana, India where he was a Silver Jubilee Scholarship fellow, Government of India. He joined Institute of Biomolecule Reconstruction (iBR), Department of Life Science and Biochemical Engineering in Sun Moon University, South Korea in 2010 and received a PhD degree in Biochemistry under the supervision of Prof. Jae Kyung Sohng in August, 2014. He worked as a Research Professor at Institute of Biomolecule Reconstruction, in Sun Moon University until March, 2016, then joined as faculty member in the same University. He has been a Visiting Professor at Piel Lab, Institute of Microbiology, wiss Federal Institute of Technology (ETH), Zurich, Switzerland. He is serving as editorial board member of Microbial Cell Factories. Dr. Pandey supervised and mentored numerous MS and PhD students, has 9 South Korean government registered patents (of which two transferred to industries), and over 75 peer-reviewed research publications. His research interests include development of metabolic engineering, system/synthetic biology tools to engineer natural products biosynthesis pathways in heterologous hosts for production of novel natural products. Particularly, elucidation of secondary metabolites biosynthesis pathways and production of those compounds in metabolically engineered microbial cells such as Escherichia coli and Streptomyces species using current synthetic/systems biology tools is the main focus. He is also focused on genome mining for identification of novel drug/ lead molecules from microbial population of unexplored symbiosis system.

Google scholar:

https://scholar.google.com/citations?user=7HMWnYAAAAAJ&hl=en

Research gate: https://www.researchgate.net/profile/Ramesh_Pandey

Sustainable Approaches For Biosynthesis of Medicinally And Cosmetically Important Glyco-Functionalized Natural Products [OP 03]

Ramesh Prasad Pandey[1,2,*]

[1]Department of Pharmaceutical Engineering and Biotechnology,

[2]Department of Life Science and Biochemical Engineering, Sun Moon University, 70 Sunmoon-ro 221, Tangjeong-myeon, Asan-si, Chungnam 31460, Korea.

*** Corresponding E-mail:** pandey@sunmoon.ac.kr; ramesh.pandey25@gmail.com

Abstract:

Post-biosynthesis modifications of natural products not only provide opportunities to bring chemical diversity to the parent molecule but also play vital roles in executing biological activities of the molecules. Thus, engineering of molecules by diverse post-modifications is increasingly becoming a tool to design or produce novel biologically potent biologics. Two approaches-1) in vitro enzymatic biosynthesis and 2) microbial biosynthesis were employed to develop chemically diverse stereoselective glyco-functionalized natural products. Bacterial genomes were mined to identify promiscuous enzymes for glycosylation of a number of natural and synthetic medicinally important metabolites. As a result, ten different sugars conjugated twenty different classes of 59 structurally diverse natural and non-natural products were produced.

To develop the rapid, green, and sustainable system for the production of different medicinally and cosmetically important plant secondary metabolite glycosides, microbial platform systems were developed in which endogenously generate cytosolic NDP-sugars are utilized as source of sugar moieties of structural units of natural products. The heterologously overexpressed natural or engineered-GT will transfer such sugars to exogenously supplemented or de novo biosynthesized natural product in microbial system. The central metabolic pathways for the production of pool of UDP-D-glucose, UDP-D-xylose, TDP-L-rhamnose, TDP-D-viosamine, TDP 4-amino 4, 6-dideoxy-D-galactose, and TDP 3-amino 3,6-dideoxy-D-galactose was engineered in E. coli BL21(DE3) cells. Different glycosyltransferases were engaged to transfer sugar moieties to aglycones. Several flavonoids, isoflavonoid, and anthocyanidin glycosides including natural and non-natural O- and C- glycosides were produced by microbial cell fermentation. This approach of microbial and enzymatic synthesis of novel glycosides derivatives of NPs using highly flexible and promiscuous enzymes from diverse sources opened up possibility of development of new molecules with better stability, bioavailability, and novel biological activity.

Keywords: Glycosides, Green and Sustainable System

Biography: Dr. Alessio Adamiano

Alessio Adamiano is a researcher for the Italian National Research Council (CNR) at the Institute of Science and Technology for Ceramic Materials (www.istec.cnr.it). He obtained his PhD in Environmental Science with a project on the analysis of protein driving biomineralization processes. Over the last five years, he has been investigating the applications of calcium phosphate materials to agriculture, green chemistry, cosmetic, regenerative and nano-medicine. He was one of the two winners of the "Green Chemistry Challenge" promoted by the Elsevier Foundation held during the 3rd Green & Sustainable Chemistry Conference on May, 2018. On May, 2019, together with Dr. M. Iafisco he was awarded by the United Nations Industrial Development Organization (UNIDO-Italy) with the International Award for Innovation in the Agribusiness 2019 for the project "phos-FATE: towards a circular economy of smart phosphorous fertilizers" on the conversion of fishery by-products into valuable agricultural products.

From Food By Products To A Circular Economy Of Smart Phosphorus Fertilizers [OP 04]

Alessio Adamiano

Institute of Science and Technology for Ceramics (ISTEC), National Research Council (CNR) Via Granarolo 64, 48018 Faenza, Italy

Corresponding E-mail: alessio.adamiano@istec.cnr.it

Abstract:

According to the Food and Agriculture Organization (FAO) of the United Nations, global food production will need to increase by about 50% by 2050 to meet global demand. Phosphorous is a fundamental plant nutrient in short supply in the soil that cannot be substituted with other elements, and is therefore vital for crop cultivation. The extensive mining of phosphate rocks, from which fertilizers are produced, and the largescale use of phosphates for agricultural purposes have depleted many of its natural supplies. At this regard, the International Fertilizer Association suggested that the peak in global phosphorus production could occur by 2033. The use of food residues as low-cost raw material represents an attractive alternative source of phosphorous for the production of valuable agricultural compounds.

In this context, we developed a process enabling the sustainable production of smart phosphorous fertilizers through the recycling of phosphate-rich by-products from the food industry, thus enlarging the pool of phosphorous resources with an alternative and renewable one. More in detail, our technology enables the production of smart fertilizers with an high level of purity from phosphate-rich residues – mostly bones – by carrying out a simple, solvent free and scalable thermal process. Beside, this will help reducing the environmental impact of fishery industry wastes whose disposal is costly both economically and environmentally.

The characteristics of the fertilizers can be tuned during the production process to obtain materials with different release rates for a more efficient absorption of nutrients by plants. To date, the efficiency of this innovative fertilizers has been evaluated on maize plants, where they have shown a better ability to stimulate their growth compared to some of the most commonly used fertilizers.

Keywords: Fishes, Phosphorous Fertilizers

Biography: Parinton Jangatawee

Parinton Jangtawee is a co-founder of a startup commercializing CU Smart Lens which is the lens that can turn a smartphone into a microscope. CU Smart Lens decreases education gap on learning experiences of student, especially in the rural schools, by enabling them to approach microscopic images easier. Moreover, Parinton is doing Ph.D. in Physical Chemistry, Chulalongkorn University. His research is about shape prediction of particulate matter from the dynamic trajectory. Before starting the business, Parinton had been interested in prototyping mobile devices such as UV-Vis photometer, dermoscope, gemoscope and fluorescent microscope.

Light-Sheet Smartphone Microscopy For Real-Time Dynamic Monitoring Of Particulate Matter [OP 05]

Parinton Jangtawee[1], Jeerasak Jitrotjanarak[2], Sanong Ekgasit[1,*]

[1]Department of Chemistry/Faculty of Science/Chulalongkorn University

[2]Chulalongkorn Demonstration School/Chulalongkorn University

***Corresponding E-mail:** sanong.e@chula.ac.th

Abstract:

Air pollution is a serious problem for people around the globe. Since human activities and industrial production continue to grow while air pollution problem keeps increasing, so experts have been developing techniques and devices to monitor particulate matter (PM) for indoor and outdoor applications. This research proposes a technique for recording movement of PM through a light-sheet using smartphone microscope. The prototype was fabricated by 3D printing. The device composed of three parts: light-sheet generator, microscope lens and air flow path. Light-sheet was fabricated by illumination of a 532 nm (green) laser beam through a cylindrical lens. The sheet was located over the field of view of the smartphone microscope lens. The light-sheet also functioned as a virtual sample holder and the confocal plane microscope detection. The 50X mobile microscope lens was attached over a smartphone camera (Huawei P30 Pro, 2019) for visualization of any particles travel through the light-sheet at 90 degree perpendicular to the light-sheet plane. The movement of the particles was captured by an embedded video application. The captured images were extracted for further investigation on trajectory size distribution, and concentration. Size and number of the particles was manually measured by calibrated pixel/length ration on ImageJ platform. The PM concentration was calculated from the number of particles divided by the volume of the light-sheet within the field-of-view (0.06 cubic millimeter per image). The dynamic video of the particles is promising to study the characteristic motion of PM. The travel trajectory can be employed for the investigation of PM behavior under various condition in order to gain an insight study of PM for further design of remediation protocols.

Keywords: Particulate matter, Smartphone microscopy

Session II

MEDICAL & PHARMACEUTICAL SCIENCES

Abstract Book
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Chair: Session II
Medical and Pharmaceutical Sciences

Biography: Professor Shishir Gokhale

Professor Shishir Gokhale is a medical post graduate with specialization in Microbiology (Infectious diseases and immunology), Pathology, Clinical biochemistry and Blood transfusion medicine. He has over 40 years' experience of working in different organization such as Indian Army medical services, research institute, medical educational institutes in India and Nepal. He has conducted numerous research projects and has large number of publications in peer reviewed national and international journals. He has been invited speaker and resource person at numerous national and international academic conferences, workshops, symposia etc.

He is a recipient of the highly competitive international Endeavour Executive award 2008, from the Government of Australia for research on the medical education. He has also been awarded in 2013 for outstanding contribution to the American Society for Microbiology's International Educators Leadership Program. He is serving as the Country Ambassador (Nepal) for the American Society for Microbiology (ASM) and a member of the Ambassador leadership Circle of ASM.

He is utilizing all these experiences and knowledge in shaping the future of undergraduate and post graduate students. His quest has contributed to the changes in teaching learning activities and restructuring the graduate level curriculum of Kathmandu University and Pokhara University, Nepal.

Co-chair: Session II
Medical and Pharmaceutical Sciences

Biography: Dr. Prson Gautam

Dr. Prson Gautam received his MSc degree in Applied Biotechnology at the Uppsala University, Sweden, and completed his PhD at the Institute for Molecular Medicine Finland (FIMM), University of Helsinki, Finland in Jan 2018. During his PhD he used chemical systems biology approach to study triple negative breast cancer with an aim to establish precision based therapeutic strategies under the supervision of Prof. Dr. Krister Wennerberg. Currently, he is working 50% as a postdoctoral researcher under supervision of Prof. Dr. Tero Aittokallio at FIMM, University of Helsinki and 50% as global project manager at Bayer. In FIMM, he aims to identify drug or drug combination against pancreatic and breast cancer, applying drug repurposing studies. Besides, he is also involved in multiple bioinformatics project to develop machine learning based predictive models to predict drug/drug combination effects and biomarkers. In Bayer, he is running/managing first in human to phase 3 clinical trials. As a scientist, he has supervised several undergrad and grad students, published more than 15 international research articles and also reviewed several research articles.

Biography: Professor Krzystof Fujarewicz

Krzysztof Fujarewicz received the M.Sc. in electronics in 1992, the Ph.D. (1999) and D. Sc. (2011) (habilitation) degrees in automatic control and robotics from The Faculty of Automation, Electronics and Computer Science of The Silesian University of Technology in Gliwice. He is currently a full professor and the head of the Department of Systems Biology and Engineering in the Silesian University of Technology in Gliwice.

His research interest concern: modelling in biomedicine, machine learning, cancer classification, feature selection and extraction, forward and adjoint sensitivity analysis of hybrid continuous-discrete systems, systems with delays and spatiotemporal systems.

A Hybrid Model For Prediction Of Lung Cancer Patients' Response To Combined Chemo-Radiotherapy [OP 06]

Fujarewicz Krzysztof[1,*], Wołkowicz Sebastian[1], Kurpas Monika[1], Łakomiec Krzysztof[1], Śmieja Jarosław[1], Suwiński Rafał[2], Świerniak Andrzej[1]

[1]Silesian University of Technology, Gliwice, Poland

[2]Maria Sklodowska-Curie Institute Oncology Centre, branch in Gliwice, Poland

***Corresponding E-mail:** krzysztof.fujarewicz@polsl.pl

Abstract:

The five-year survival rate for lung cancer is low in Poland (12.15%). The use of an appropriate treatment protocol is crucial for prolonging the patient's survival time or for achieving complete remission. The main methods of treating lung cancer are radio and chemotherapy. During radiotherapy with ionizing radiation, the area of the tumor and surrounding tissues are irradiated. Due to interaction with water particles in the radiolysis process, reactive oxygen species are produced, leading to damage of cellular components, including DNA. This damage, in turn, leads to apoptosis or necrosis of cells. Radiation affects also healthy tissues surrounding the tumor and is linked to cardiac events which are a common cause of death for lung cancer patients. Chemotherapy is aimed at killing tumor cells by damaging their DNA or at inhibiting cellular division. It is a systematic treatment associated with various negative side effects, including cancerogenesis in healthy tissues. Thus, it is important to reduce the side effects of therapy and maximize the number of cancer cells killed.

The goal of this work is to develop a method to predict treatment outcome for the combined chemo-radiotherapy for non-small cell lung cancer patients and fit the model to real survival data. A similar problem has been considered in (Geng et al. 2017), where the fitting procedure consisted in estimation of distributions of parameters of the kinetic model of tumor growth. In this work, instead of using a fitted distribution of parameters to generate a cohort of virtual patients, we propose a hybrid model, assuming that there exists a relation between available proteomic data and parameters of the kinetic model for each individual patient. Alterations of plasma proteins are reported in cancer patients, they are also linked to the inhibition of apoptosis of the cancer cells (Vejda et al. 2002). Thus, one of the components of the hybrid model are linear functions mapping available proteomic data into parameters of the kinetic model. Comparison of clinical and simulation-based survival curves is used to evaluate the quality of the model. This work was supported by the Polish National Science Center grant 2016/21/B/ST7/02241.

Keywords: Combined chemotherapy, Lung cancer

Biography: Dr. Suraj Bhattarai

Suraj Bhattarai, MBBS, MSc, DTM&H is a Public health specialist and Tropical medicine physician from Nepal. He is a founding executive member, a research fellow, and the co-lead of global health programme at the Global Institute for Interdisciplinary Studies (GIIS) (www.thegiis.org). Additionally, he is the co-PI for 'MAUN' project at Gandaki Medical College, where his team is exploring microbiological & pathological causes of clinical deaths in the Gandaki region using minimally invasive tissue sampling techniques. Previously, he worked as a clinical research fellow at Patan Hospital getting involved in a number of studies (sponsored by the University of Oxford) about invasive bacterial infections in children. He has been awarded membership of Global Young Academy in 2018, and IAP-Young Physician Leaders Programme in 2016. He also works remotely with the ESPID, USAID's STAR, and other global health projects.

Dr. Bhattarai grew up in Pokhara and completed medical training from BPKIHS, Dharan, after which he received formal & informal training in child health, translational research (epilepsy), and clinical research from USA & Europe. His research interests are in infectious & tropical diseases (biology & intervention strategy), vaccines, cancer, health technology, health policies, and transdisciplinary science. He recently completed Master's degree in Tropical Medicine & International Health from the London School of Hygiene & Tropical Medicine (LSHTM), University of London (UK) where, for his thesis, he looked at high-risk HPV- and HIV-related risk factors for 'multifocal' cervical cancer among HIV-infected women in Africa.

Inter-linkages Between Various Disciplines Of Medical & Allied Sciences: An Opportunity For (Bio) Medical Students, Graduates And Researchers [OP 07]

Suraj Bhattarai

Global Institute for Interdisciplinary Studies (GIIS), Kathmandu, Nepal

Corresponding E-mail: surajbpkihs2012@gmail.com

Abstract:

The global academic diaspora has been discussing much about multidisciplinary, interdisciplinary, and transdisciplinary approaches of learning, conducting research, and deploying interventions. Scientists have explored connections and disconnections between various disciplines of medical & allied sciences too. Amid this global development, a less-privileged group of (bio)medical students, graduates and researchers in low-resource countries like Nepal could be misguided in their career path if they do not receive appropriate mentorship.

Few examples where various disciplines of medical & allied sciences come into play are - potential use of artificial intelligence in screening, diagnosing, and treating many human diseases; use of gene-editing techniques for treating medical conditions; biological research and uptake of traditional medicines; threats of multi-drug resistant pathogens and mortality; vaccine research and public acceptance.

In this session, such examples of inter-linkages between various disciplines of medical science will be discussed from a global perspective, which are also relevant to the local context. The audience would then be encouraged to get involved in interdisciplinary research not only as a career but also for societal benefits.

Keywords: Biomedical science, Interdisciplinary research, Global to local

Biography: Dr. Alba Abad Fernandez

Alba Abad Fernandez is a research scientist at the Wellcome Centre for Cell Biology in Edinburgh (Edinburgh, UK). She graduated as a Biologist from the Universitat Autònoma de Barcelona (Spain) in 2003 and obtained her PhD in Neuroscience from the Universitat de Barcelona in 2008. Alba's main research interest is understanding the molecular basis for accurate chromosome segregation, essential for faithful segregation of the genetic material during cell division. Her research career thus far has resulted in 14 peer-reviewed publications with 5 of them as a lead author in high-impact journals. Currently she is using an interdisciplinary approach combining protein biochemistry, biophysics, X-ray crystallography, CryoEM and cell biology to characterise key mitotic regulators. Alba is also passionate about public engagement with science and is currently running 'Engage Nepal with Science' together with the RIBB. 'Engage Nepal with Science' aims to spread the culture of engaging Nepalese communities with science and the scientific research carried out at Nepalese research centres to empower, inspire and build confidence in STEM (Science-Technology-Engineering-Mathematics).

LinkedIn profile: https://www.linkedin.com/in/alba-abad/

Twitter: EngageNepalSci

Facebook: @EngageNepalwithScience

Direct Nucleosome Binding Activity Of Borealin Secures Chromosome Association And Function Of the Chromosomal Passenger Complex

[OP 08]

Alba Abad Fernandez

Wellcome Centre for Cell Biology, University of Edinburgh, Edinburgh, UK

Corresponding E-mail: mabadfe@exseed.ed.ac.uk

Abstract:

Cell division is an essential biological process that ensures accurate distribution of genetic material to the newly formed daughter cells. Errors in cell division result in cells with an abnormal chromosome number which is often associated with birth defects and diseases like cancer. The Chromosomal passenger complex (CPC; composed of Borealin, Survivin, INCENP and Aurora B kinase) is one of the major regulators of cell division. CPC localises to specific sites during different stages of mitosis where it coordinates several chromosomal, cytoskeletal and membrane trafficking events. During early stages of cell division, CPC localises to the centromeric region of chromosomes where it regulates kinetochore-microtubule attachments and influences the spindle assembly checkpoint, a surveillance mechanism essential for error-free chromosome segregation. Here using a multifaceted approach, we identify Borealin as a major driver targeting the CPC to chromosomes as a result of its direct nucleosome binding activity. Furthermore, disrupting Borealin-nucleosome interactions excluded the CPC from chromosomes and caused chromosome congression defects. Our work thus establishes Borealin as a master regulator determining the chromosome association and function of the CPC.

Keywords: Borealin, Cell division, Chromosomal passenger complex

Biography: Dr. Roman Jaksik

Roman Jaksik received his Ph.D. in biocybernetics and biomedical engineering from the Silesian University of Technology in 2013. He is currently an assistant professor at the Department of Automatic Control in the Silesian University of Technology, Poland. He is an author or co-author of more than 50 journal articles, book chapters and conference papers. His research interest's concern development of novel bioinformatic methods for the study of data obtained using high throughput measurement methods as well as study of intracellular processes related to the development and progression of cancer.

Precision Of Gene Expression Measurement Methods In Biomedical Research [OP 09]

Roman Jaksik*, Anna Lalik, Krzysztof Puszyński

Institute of Automatic Control, Silesian University of Technology, Gliwice, Poland

***Corresponding E-mail:** roman.jaksik@polsl.pl

Abstract:

Studies of changes in gene expression levels provide invaluable information on the state of living cells, being one of the basic methods used in biomedical research. However despite their increasing usefulness, studies of gene expression on the RNA level suffer from significant reproducibility problems, related to the nature of the biochemical reactions utilized. Both low and high-throughput methods that can measure RNA levels from one to tens of thousands different molecules in a single experiment are biased by the nucleotide structure of the studied RNAs, which affect the efficiency of amplification, reverse transcription and hybridization reactions utilized in the measurement process. Data pre-processing methods aim at reducing the influence of those factors on the experiment results, however their efficiency is limited by the lack of information on the association between individual biochemical processes and measured signal levels.

In this work we assess the precision and reproducibility of gene expression measurement methods, identifying the main sources of measurement inaccuracies that can affect interpretation of results. By studying data from thousands of experiments that utilize RT-qPCR, oligonucleotide microarrays or RNA sequencing technologies, available in public repositories and originating from experiments performed by our group, we show how nucleotide structure-related bias can affect detection of differentially expressed genes. We also propose a novel data preprocessing algorithm, based on correction curves obtained by studying the influence of individual experiment stages on the experiment outcomes. The method utilizes information on nucleotide structure of individual genes, including their GC composition and occurrence specific sequence motifs, and raw expression intensities obtained in the experiment, to fit the correction curves, later used to transform the data. The usefulness of the method was validated using four benchmark datasets for which we identified differentially expressed genes before and after correction comparing them to the expected values using AUC estimates of the ROC curves.

Our work shows that even results from previously conducted studies can benefit from a novel data pre-processing algorithm, increasing their usefulness and potentially leading to new discoveries in biomedical research. This work was supported by the Polish National Science Centre grant No. 2016/23/D/ST7/03665.

Keywords: Gene expression, Precision, Real Time PCR.

Biography: Dr. Prabhat Bhusal

Prabhat Bhusal, PhD. (University of Auckland, 2017) is a pharmaceutical scientist by training and is currently working as Research Fellow & Team Leader at Bayer Research Center based at the School of Pharmacy, University of Otago in New Zealand. Prabhat's research broadly focuses on the development and characterization of different drug delivery systems and medical devices for human and veterinary applications. His research, while being central to drug delivery, has interfaced various disciplines including surgery, analytical chemistry, physiology, microbiology and veterinary; contributing to several commercial products, journal publications, conference proceedings and a recently-filed patent. Prior to his current role, Prabhat completed his PhD study at the University of Auckland in New Zealand. With emphasis on managing post-operative complications, his PhD focused on developing implants and gels to provide controlled release of local anesthetics for effective pain relief following surgery. During his Masters' study in Chosun University in South Korea, he developed gastro-retentive granules to provide controlled release of a drug in the upper GI tract. Prabhat worked in Omnica laboratories in Nepal after completing a Bachelor's degree in Pharmaceutical Sciences from Pokhara University in Nepal in 2006. His future goal is to extend the applications of drug delivery beyond human and animal healthcare, channeling more opportunities for collaborations and convergence to produce innovations.

For more information, please click the link below:

Prabhat Bhusal

Linkedin

Researchgate

Applications Of Drug Delivery Systems Into Human And Veterinary Health Care And Beyond: More Opportunities For Convergence And Collaborations [OP 10]

Prabhat Bhusal

School of Pharmacy, University of Otago, Dunedin, New Zealand

Corresponding E-mail: prabhat.bhusal@otago.ac.nz

Abstract:

Drug delivery systems are designed to control the rate, time and place of medicine release after their administration into the body; which in turn will prolong the therapeutic effect of medicine while reducing the adverse effects of medicine through its lowered plasma concentration. With the established translational pathways from lab bench to the market, research into drug delivery systems for human and veterinary applications will continue to grow, and more drug delivery systems will enter into the market in the future. In addition to human and veterinary healthcare, however, it would be interesting to utilize the delivery platform to other applications, for example, food industry, agriculture, cosmetics industry and antibiotic resistance. This opportunity could address untapped needs allowing convergence for multidisciplinary collaborations. The aim of this session is to provide an overview work in drug delivery systems and medical devices for human and veterinary applications, and highlight a series of examples of delivery platforms that have the potential for further exploration to other applications.

Keywords: Drug delivery, Human, Veterinary

Biography: Dr. Basant Giri

Basant Giri received BSc and MSc in chemistry from Tribhuvan University, Kathmandu, Nepal, a second MS degree in chemistry from the Oregon State University, Corvallis, USA. He completed his PhD degree in analytical chemistry from the University of Wyoming, Laramie, USA. After completing his studies in the USA, he co-founded Kathmandu Institute of Applied Sciences (KIAS) and currently works as a scientist and director of international relations at KIAS. His research interest includes development of new technologies appropriate in resource-limited settings. Dr. Giri has also been working on science policy and science outreach projects. International Foundation for Science, Sweden, The World Academy of Science, Italy, and National Science Foundation, USA, National Academy of Sciences/USAID have funded his research works in Nepal. He has several years of teaching experience in high school, undergraduate, and graduate levels in Nepal and USA as a faculty and teaching assistant, respectively. Dr. Giri has authored/co-authored several peer-reviewed research articles and two books in addition to giving more than 30 scientific talks.

Contact:
Dr. Basant Giri
Scientist & Director of International Relations
Kathmandu Institute of Applied Sciences, Kathmandu, Nepal
PO Box: 23002
Email: bgiri@kias.org.np
http://www.kias.org.np

Point-Of-Need Screening For Drug Quality [OP 11]

Basant Giri[1,*], Toni Barstis[2]

[1]Center for Analytical Sciences, Kathmandu Institute of Applied Sciences, Kathmandu, Nepal

[2]Saint Mary's College, Notre Dame, IN, USA

***Corresponding E-mail:** chembasant@gmail.com

Abstract:

Low-quality medicines are unregulated, substandard and/or falsified (SF) medicines. The SF medicines pose a significant threat to human health and socio-economy. These low-quality drugs are a global problem with more severe impacts in low-and middle-income countries (LMICs) with a prevalence of 13.6%. The SF medicines cause billions of dollars of economic impact in LMCs only. One of the challenges of controlling such medicines circulating in the market is to have a system to detect the drug quality and respond quickly to any incidents that are detected onsite. Conventional drug quality test methods such as spectroscopic and chromatographic are accurate and reliable but they are expensive, require well-set up laboratory facility and trained user. Therefore, such methods are not the best ones for resource limited and field settings in a country like Nepal that lack the funding, facilities, or expertise for the purchase, usage, or maintenance of these instruments for routine analysis. There is a need of technologies that are low in cost, scalable, fast, adaptable to specific communityneeds, and appropriate in field. In this presentation, I will discuss about point-of-need technologies for screening drug quality in the field. Specifically, I will describe our work on paper analytical device (PAD). We have developed PADs that are comparable to a business card in size and can be used at point-of-need by a person without advanced training.It consists of several cellulosic paper lanes impregnated with reagents for colorimetric reactions. The PADs produce a library of colors in the cellulosic lanes when sample is applied onto them. Analysis of the color library tells us the presence or absence of active pharmaceutical ingredients (API), excipient, and contaminants. We have tested these PADs devices with drug samples representing different categories such as antibiotics, anthelmintic, antacids, antidiabetic etc. collected from five different regions in Nepal.The same samples were also tested with HPLC following standard pharmacopeia methods. We found that the PADs correctly predicted the presence of active pharmaceutical ingredients in most of the samples. Ournewly developed paper device was successful in reliably, quickly, and easily screening the quality of albendazole in the field.

Keywords: Counterfeit drug, Falsified medicine, Paper analytical device, Nepal

Biography: Niraj Aryal

Niraj Aryal is a graduate of Kathmandu University. He acquired his MS (Research) degree also at Kathmandu University with a research exchange to Sun Moon University, South Korea in year 2012. There, he worked on metabolic engineering and genetic manipulation of actinomycetes. He received DAAD fellowship in 2016 to pursue his PhD at University of Tübingen, Germany. In close collaboration with Research Institute for Bioscience and Biotechnology (RIBB), Niraj is screening and characterizing rare actinobacteria from unique ecological niches of Nepal and investigating their chemistry via various computational and chemical approaches. He routinely focuses on genome-driven discovery of microbial secondary metabolites, its biosynthesis and characterization with the use of NMR and Mass spectrometry.

'Secondary Metabolomics' – An Actinobacterial Perspective [OP 12]

Niraj Aryal[1], Keshab Bhattarai[1], Prajwal Rajbhandari[2], Harald Gross[1,*]

[1]University of Tübingen, Pharmaceutical Institute,
Department of Pharmaceutical Biology, 72076, Tübingen, Germany

[2]Research Institute for Bioscience and Biotechnology (RIBB), Kathmandu, Nepal

***Corresponding E-mail:** harald.gross@uni.tuebingen.de

Abstract:

Antibiotics have been a medical success story ever since they were first used. With the rise of Multi Drug Resistant (MDR) pathogens, better alternatives for finding new chemical entities are urgently needed. Over the last few decades, rediscovery of known compounds had brought a substantial decline in the drug discovery pipeline. However, with the advent of genome mining and modern analytical approaches, natural product chemistry has bounced back.

In combination, mining the unique habitats for a new chemical space can be a great alternative. Nepal is an underexplored country when it comes to microbial natural products. In this study, we therefore investigated for the first time the taxonomic and chemical diversity of Nepalese actinomycetes, employing state of art technologies. In past 2016, we initiated a collaborative program with RIBB, Nepal which resulted in isolation, characterization and screening of more than 100 actinobacterial strains. In this talk, we will report about the biodiversity and chemical potential of 22 prioritized Nepalese strains.

Keywords: Actinobacteria, Genome mining, Secondary metabolites

Biography: Dr. Ajit Kumar Karna

I am a veterinarian, public health scientist, virologist and epidemiologist. My interest is in One Health research and development. What fascinates me the most is the complexity of pathogen transmission dynamics in a human-animal-environmental triad, and what I like doing is enhancing collaboration and co-ordination with public health, wildlife, livestock, environment, education, and other relevant domains of the countries for tracking zoonotic diseases and consequences of infectious diseases using existing and new tools and guidelines.

Application Of A One Health Approach To Evaluate Risk Of Japanese Encephalitis Virus Infection In Households Of Nepal [OP 13]

Ajit Kumar Karna[1,2,*], Francisco Olea-Popelka[3,4], Shamjhana Kafle[5], Tapendra Prasad Bohora[5], Richard A. Bowen[1,6]

[1]Department of Microbiology, Immunology, and Pathology, Colorado State University, Fort Collins, Colorado, United States of America

[2]Centre for Health and Disease Studies-Nepal, Kathmandu, Nepal

[3]Department of Clinical Sciences, Colorado State University, Fort Collins, Colorado, United States of America

[4]Department of Pathology and Laboratory Medicine, Schulich School of Medicine and Dentistry, Western University, London, Ontario, Canada

[5]Central Veterinary Laboratory, Department of Livestock Services, Government of Nepal, Kathmandu, Nepal

[6]Department of Biomedical Sciences, Colorado State University, Fort Collins, Colorado, United States of America

***Corresponding E-mail:** ajit.karna@gmail.com

Abstract:

Japanese encephalitis virus (JEV) infection is common in humans and other animals in Asia. The areas suitable for paddy farming and amplifying/reservoir host farming are ecologically excellent drivers for virus transmission. The objective of this study was to use an interdisciplinary one health approach to obtain a better understanding of the ecology and epidemiology of JEV infection in the households of farming communities of Nepal. A cross-sectional study was conducted during 2014 in Rupandehi district of Nepal involving 183 households with pigs, ducks, or chickens. Blood samples from 339 pigs, 288 ducks, and 209 chickens were tested for anti-JEV antibodies by indirect fluorescent antibody assay. Seroprevalence and risk factors for JEV infections were characterized for each species. Coincidentally, a knowledge, attitude, and practice (KAP) survey was conducted in the same households to assess current practices for mosquito population control and prevention of mosquito bite. Additionally, weekly mosquito sampling in the same study district was carried out at eight different locations. Seroprevalence in pigs, ducks, and chickens was estimated to be 14.7%, 11.8%, and 6.7%, respectively. The household-farm level seroprevalence of JEV was 31.7%, 31.6%, and 12.8% for

pigs, ducks, and chickens, respectively. The major risk factors for JEV infection in these animals were age, locality, household fermentation practices, farm size, and location of the farm. However, the risk factors differed by species of animal. Depending on several aspects of knowledge, attitude, and practices, one or the combination of factors were found to be associated with preventative measures. *Culex tritaeniorhynchus* was the most common vector identified during the study period, although 16 additional *Culex* species were detected. The results delineated JEV exposure in ecologically-relevant livestock hosts, abundance of vectors known to transmit JEV to humans and livestock, and sociological factors that could influence JEV transmission in Rupandehi district of Nepal. These findings support the contention that the study environment was highly conducive to virus transmission and that humans are at substantial risk of contracting JEV at a household level.

Keywords: *Culex* mosquitoes, Domestic animals, Emerging infectious diseases Japanese encephalitis virus, One Health, Nepal, Zoonoses

Session III

FOOD TECHNOLOGY & APPLIED MICROBIOLOGY

Abstract Book
ICBB 2020

Keynote Speech – 02

Chair: Session III
Food Technology and Applied Microbiology

Biography: Professor Remco Kort

Professor Remco Kort (Rotterdam, 1970) is holder of the TNO Chair Microbial Genomics at the VU University Amsterdam, Professor at Micropia (world's first microbe museum), and founded the Yoba for Life foundation together with Wilbert Sybesma. Remco Kort graduated cum laude in Molecular Sciences at Wageningen University, carried out his PhD-study in molecular microbiology at the University of Amsterdam, and post-doctoral studies in X-ray crystallography at the ESRF in Grenoble (France) and Nara Institute of Science and Technology (Japan). Awards include Excellent Researcher of the year 2008 at TNO. Remco Kort supervised numerous research projects in applied microbiology for the food industry, has 4 patents (of which one licensed), and over 50 peer reviewed publications. Via his multiple positions, Remco Kort is currently involved in research and public engagement in the area of human microbiota and probiotics. Remco has been active in east-Africa over the last 5 years, where he set-up the probiotic yoghurt Yoba initiative that currently reaches tens of thousands of people.

Development And Application Of A Probiotic Starter Culture For Functional Fermented Foods [KN 02]

Remco Kort[1,2,*], Wilbert Sybesma[2]

[1]VU University Amsterdam, Netherlands

[2]Yoba for Life foundation, Amsterdam, Netherlands

***Corresponding E-mail:** r.kort@vu.nl

Abstract:

In resource disadvantaged countries, poor hygienic conditions, malnutrition, frequently lead to respiratory tract infections and diarrheal disorders, in particular in children. In addition, the warm and humid climate allows for food contamination with fungi leading to the presence of mycotoxins in frequently consumed cereals such as maize. People in these countries might benefit from consumption of functional fermented foods containing probiotic bacteria, which are able to reduce of the incidence or severity of infectious diseases and the uptake of mycotoxins in the body. The aim of this research is to provide access to functional fermented foods through the development of a bacterial starter culture allowing dairy farmers and small-scale entrepreneurs in East-Africa to convert their locally produced milk into a probiotic yoghurt. A second aim is to assess the health benefits of the probiotic yoghurt on local consumers. A dried probiotic starter culture has been developed, containing the world's best documented probiotic strain, the human gut isolate *Lactobacillus rhamnosus* GG. The strain's inability to grow in food matrices like milk was surmounted by the formulation of a dried starter consortium with an adjuvant strain of *Streptococcus thermophilus*. Fermentation of milk and cereals with the developed starter culture leads allows propagation of *L. rhamnosus* up to titers of 1 x 10^9 cfu ml^{-1}. Fermentation of a maize-based food with the starter led to an over 1000-fold reduction of aflatoxins B_1, B_2, G_1, and G_2 spiked in the raw ingredients. Sachets prepared with the two strains retained viability for at least 2 years. A nutritional trial with 1116 school-going children of 3-6 years old suggested a reduced incidence of common cold as well as skin disease such as Tinea capitis, among children consuming probiotic yoghurt compared to children consuming milk. A stable dried starter culture has been developed, which facilitates local and low-cost production of functional fermented foods (currently > 250 companies in 6 countries produce over 30,000 liters of probiotic yoghurt per week). More studies are needed to substantiate health benefits of probiotic yoghurt in favor of milk in our target population.

Keywords: Functional Foods, Probiotics, Yoghurt

Biography: Dr. Sergey Mikhaylin

Dr. Sergey Mikhaylin is an assistant professor at the Department of Food Sciences, Laval University (Quebec City, Canada). He is a member of the Institute on Nutrition and Functional Foods (INAF), the Dairy Research Center (STELA) and the International Associated Laboratory on the Bioproduction of Natural Antimicrobials (LIAAN). He is associate professor at the NSERC Industrial Research Chair in Electro membrane Processes for Improving the Efficiency of Bio-Food Production Lines (PEMECO).

Dr. Mikhaylin graduated as a chemistry specialist in 2009 and he obtained a master's degree in electrochemistry in 2011 at the Kuban State University of (Krasnodar, Russia). He pursued his studies at Laval University (Quebec, Canada) where he obtained a Ph.D. in food science and technology. He completed a postdoctoral internship in the Laboratory of Food Processing and Electromembrane Processes. He was at the heart of several international collaborations: with the French-Russian international associate laboratory MEIPA in 2013, the research laboratory of electronics at the Massachusetts Institute of Technology in 2014 and the laboratory of agro-industrial technologies of the University of Technology of Compiègne in 2016.

Dr. Mikhaylin develops his activities in the fields of eco-efficiency and high-voltage electrical treatments applied to the food sector. He studies the environmental impacts and eco-efficiency of food processing using electromembrane technologies in the context of the NSERC Research Industrial Chair.

He is the author of more than 20 scientific publications in peer-reviewed journals, several of which have a high impact factor (Green Chemistry, Advances in Colloid and Interface Science, Journal of Membrane Science, etc.) and a two book chapters in Reference Module in Food Science (Elsevier) and Manual of dairy technology (Presses de l'Université Laval). Dr. Mikhaylin is a co-chairman of the international conference GreenFoodTech.

High Voltage Electrotechnologies For The Ecoefficient Conversion Of Protein Food By-Products In Biologically Active Peptides [OP 14]

Sergey Mikhaylin[1,2,3,*], Rock-Seth Agoua[1,2], Zain Sanchez-Reinoso[1,2,3], Laurent Bazinet[1,3], Eugène Vorobiev[4], Nabil Grimi[4]

[1]Institute of Nutrition and Functional Foods (INAF), Dairy Research Center (STELA), Food Science Department, Université Laval, Québec , QC, Canada

[2]Laboratory of Sustainable Food Processing (LSFP), Food Science Department, Université Laval, Québec, QC, Canada

[3]Laboratory of Food Processing and Electro-Membrane Processes (LTAPEM), Food Science Department, Université Laval, Québec, QC, Canada

[4]University of Technology of Compiègne, Laboratory of Agro-industrial technologies, Compiègne, France

***Corresponding E-mail:** sergey.mikhaylin@fsaa.ulaval.ca

Abstract:

By 2050, global food demand is expected to increase by 50% due to the ever-growing world population. Moreover, the modern consumers require the highly nutritious food having minimal environmental impacts. To satisfy the needs and high quality food standards of the current and future society, agri-food industries must considerably improve their performances. At the same time, the very important issue of food loss and waste is ubiquitous in contemporary global food chains. Indeed, almost one third of the globally produced food is lost or wasted leading to the harmful environmental, social and economic consequences. To answer the above-mentioned problematics, the present work proposes the ecoefficient solutions dealing with the use of high voltage electrotechnologies to convert the protein-based agri-food by-products in the high value biologically active products. High voltage electrotechnologies consist of the application of high voltages (5-60 kV) in pulse mode (ns to µs) to treated product situated between plane-plane electrodes (Pulsed Electric Field) or needle-plane electrodes (Arc). During the treatment, the product is exposed to several physical and chemical phenomena (e.g. mechanical stress, UV light, chemically active species). This exposure can provoke the electroporation of biological membranes, cell disintegration and changes in the structure and properties of different food molecules. In the case of protein-enriched by-products (e.g. whey or slaughterhouse blood), the applications of high voltage electrical treatments can affect the protein structure increasing its susceptibility to the further enzymatic hydrolysis and release of bioactive peptides (antidiabetic, antimicrobial,

anticancer, etc.). Indeed, our results showed that application of short high voltage pulsations of 10 µs during several minutes (1-10 min) to studied proteins leads to the substantial improvement (more than 2 times) of peptide generation by enzymes. Moreover, the release of certain peptides was registered after high voltage electrical treatments even before the addition of enzyme. This fact indicates the possibility to avoid the use (or to substantially decrease the concentration) of expensive enzymes.

Thus, the results of our work demonstrate a significant improvement of enzymatic hydrolysis of proteins by low energy intensive electrical technology. Such advancements can convince industries to choose this path of valorization of protein-enriched by-products into high added-value products having multiple biological and functional properties.

Keywords: Electrotechnologies, Ecoefficiency, Proteins, Valorization

Biography: Dr. Namrata Karki Kandel

Namrata Karki Kandel, Ph.D. is a Senior Research Scientist at Ortho Molecular Products Inc. located at Stevens Point, Wisconsin, USA. She is an active member of Institute of Food Technologists (IFT) and is serving as a Chair of IFT Biotechnology Division (2019-20). She received her M.S. and Ph.D. in Food Science at Louisiana State University, USA. She graduated from Kathmandu University in 2008 with a bachelor's degree in Biotechnology. She is happily married and is a proud mom of a beautiful toddler girl. She is a strong believer of "Optimism is the foundation of courage". She enjoys reading personal development books and finds herself volunteering at non-profit organizations in her spare time.

Technological Innovations For Development Of Nutraceuticals And Functional Foods [OP 15]

Namrata Karki Kandel

Ortho Molecular Products Inc., 3017 Business Park Drive, Stevens Point, WI 54481, USA

Corresponding E-mail: namrata.karki22@gmail.com

Abstract:

Identification of bioactive components in food with proven health benefits has been the key to the acceleration in the development and innovations in the nutraceuticals and functional foods industry. The global nutraceuticals market is valued at US$ 230 billion and is forecasted to continually grow. In order to keep up with this ever-increasing consumer's demand, research institutes and industries have harnessed the power of technology and adopted unique operational processes. Cases of bioactive ingredients that have undergone evolution through applied technologies for improved quality and enhanced functionality will be highlighted. Contexts such as the use of novel microbial fermentation processes in manufacturing of bioactive ingredients such as Coenzyme Q1O as an example of technological innovations in nutritional space will be discussed. Also, a brief synopsis on the current state of research and development on curcumin, which is one of the very popular bioactive from turmeric will be provided. Overall, this presentation is an attempt to provide the audience a unique perspective and insights on various value-added commercialized nutraceuticals and functional foods designed for health and wellness.

Keywords: Coenzyme Q10, Curcumin, Functional Foods, Food Technology, Microbial Fermentation, Nutraceuticals, Supplementation

Biography: Dr. Alice Marciniak

Dr. Alice Marciniak is a Ph.D. graduate in Food Science and Technology from Laval University, Canada. For her Ph.D., she worked with high hydrostatic pressure to separate the main proteins from cheese whey. She has a background in Food Biochemistry, Food processing and Dairy Science, and has a master degree from France in food waste valorization. She is now working as a Postdoctoral researcher at the department of Food Science of The Ohio State University, in the research team of Dr. Rafael Jimenez-Flores. Her current research work focus on milk bioactive components fractionation and characterization.

Isolation Of Highly Valuable Components From Processed Dairy Sources And Wastes, Characterization And Study Of Potential Health Benefits

[OP 16]

Alice Marciniak*, Joana Ortega-Anaya, Rafael Jimenez-Flores

Department of Food Science, The Ohio State University

***Corresponding E-mail:** Marciniak.29@osu.edu

Abstract:

The consumption of dairy products is in decreasing trend since the last few years in the US. Therefore, dairy industries are focused on development of innovative high value products and ingredients from milk and its by-products, to enhance their valorization. Among those highly valuable fractions, milk vesicles (MV), milk fat globule membrane (MFGM) and Immunoglobulins (Ig) are of great interest. While MV are long considered as an ejection mode of cell waste, they have been recently proposed as a novel intercellular communication path and are rich in very valuable and essential phospholipids as well as specific protein that is comparable to the structure of the MFGM. MFGM remains one of the hot topics in the dairy field, and have shown very interesting bioactivities, which suggest a tremendous potential for exosomes. Moreover, even though Igs represent a very small fractions of the total proteins, their well-known role in the immune system remains of great interest. However, the isolation of those highly valuable components while maintaining their bioactivities requires gentle processing. Therefore, the objectives of this study are 1) to develop a gentle fractionation process of MV, MFGM and Igs from milk and other dairy side streams (buttermilk and cheese whey), 2) characterize their physico-chemical properties, and finally 3) study their stability and bioactivities after different processing (pasteurization, churning, renneting).

Keywords: Dairy Products, Valorization

Biography: Dr. Denise Felix da Silva

Dr. Denise Felix da Silva is Industrial Postdoc at the Department of Food Science, University of Copenhagen in collaboration with the leading cheese powder company, Lactosan A/S. She graduated as a Food Engineer in 2013 and she obtained a master's degree in Food Science in 2015 from the State University of Maringá (Maringá, Brazil). She obtained her PhD in Food Ingredients and Dairy Technology from University of Copenhagen in 2018. She is the author of more than 10 scientific publications in peer-reviewed journals. Her main research interest is within dairy products and the relations between composition, processing and functionality. Currently, the main focus of her research is within dairy powders, more specifically on the effects of processing and raw materials on the cheese feed and powder properties.

Cheese Feed To Powder: How The Various Factors During Manufacture Can Affect The Feed And Powder Properties? [OP 17]

Denise Felix da Silva

Department of Food Science, University of Copenhagen, Denmark

Corresponding E-mail: denise@food.ku.dk

Abstract:

Cheese powders are used as a multifunctional ingredient in sauces, soups, and dressings to provide a unique combination of taste, functionality, and convenience. They are produced by spray drying of a mixture of minced cheeses, water and other ingredients such as emulsifying salts, heated to form a homogeneous emulsion, called as cheese feed. Physical, chemical and functional properties of cheese feed and powder properties can be affected by the use of different cheese raw materials and their composition, addition of ingredients, homogenization, spray drying and dry mixing conditions. Thus, we investigated the various factors affecting the cheese feed and powder properties. Also, significant emphasis was given in developing and understanding the properties of cheese powders without addition of emulsifying salts. To ensure a high final quality cheese powders, the homogeneity and stability cheese of feeds are important for further processing and final product quality. The use of 30 weeks old ripened cheeses gave rise to more stable and homogenous feeds. Likewise, we showed that cheese powder properties such as flowability, microstructure and rehydration were affected. The absence of emulsifying salt caused formation of irregular and rough powder particles, which is suggested to be due to presence of free fat on the particle surface. Agglomerated powder particles showed enhanced swelling but unchanged rehydration properties compared with non-agglomerated powder. The presence of lactose in amorphous state created powders with smaller particles, faster dissociation, better solubility and rehydration ability. In this way, we provided inputs to manufacture tailor made cheese powder with desired quality and functionality.

Keywords: Cheese powder, Lactose

Biography: Dr. Shyam Suwal

Shyam Suwal is currently an Assistant Professor at the Dept. of Food Science of the University of Copenhagen, Denmark. Dr. Suwal received his PhD degree in Food Science and Technology from Laval University, Canada and MSc degree in Food Microbiology from INSA-Toulouse, France. Before joining the University of Copenhagen, Dr. Suwal worked as postdoctoral fellow at Laval University and Purdue University, USA. Dr. Suwal's research focuses on the development of innovative and sustainable food processing technologies for the production of healthy foods and beverages. Dr. Suwal specializes on the effects of non-thermal technologies on food properties and application of membrane process for the fractionation of added value products from industrial by-products. He has been supervising more than 10 MSc and PhD students and published more than 25 research articles in international journals.

Trends In Dairy Byproducts Valorization Using Emerging Technologies [OP 18]

Shyam Suwal
Arla Foods Amba, Arla Innovation Center, Agro Food Park 19, DK-8200 Aarhus, Denmark
Corresponding E-mail: sksuwal@gmail.com

Abstract:

Dairy processing industries generate a large volume of byproducts whose disposal remains an important worldwide problem. Due to high volumes of production, environmental impact, and nutritional content, such byproducts are considered important subject for careful valorization. For instance, whey a major dairy byproduct contains industrially valuable molecules such as proteins, lactose and minerals. Therefore, dairy industries are continuously in search for sustainable technologies for the production of high value products and ingredients from such byproducts. To create value from these low-value resources, individual components from the whey have to be fractionated. Conventionally, pressure driven membrane filtration processes have been used to fractionate food components. However, these methods lack selectivity and process efficiency is limited due to membrane fouling. Non-thermal processes such as electrodialysis with filtration membranes (EDFM), high hydrostatic pressure (HHP) and pulsed electric field (PEF) are considered as viable technologies to enhance the fractionation. In this presentation, the effect of EDFM, HHP and PEF technologies on the whey protein structure, protein-protein interaction and fractionation of proteins and minerals will be presented as novel and sustainable approach. In addition, production of galactooligosaccharides (GOS) from cheese whey using microalgae will be presented as a method for whey valorization.

Keywords: Dairy byproducts, Galactooligosaccharides, Valorization

Biography: Dr. Santosh Koirala

Santosh Koirala, PhD got his Bachelors of Science in Chemical Engineering from Texas A&M University (TAMU) in 2009. He then went on to get his Masters of Science and PhD in Chemical and Biological Engineering from University of Illinois at Urbana Champaign UIUC). He graduated from UIUC in 2015. While at Illinois, he determined that nutrients tune the fraction of motile cells and cells expressing flagellar gene in *Salmonella typhimurium* and elucidated the roles of various regulators involved in fractional response. He further demonstrated that flagellar gene network is bistable and hysteretic both experimentally and mathematically. In *Escherichia coli*, he elucidated the switching mechanisms in arabinose and xylose metabolism gene networks. He has expertise in state-of-the-art molecular biology techniques, biotechnology, operational intelligence and digital transformation.

Reciprocal Regulation Of l-Arabinose And D-Xylose Metabolism In Escherichia Coli [OP 19]

Santosh Koirala*, Xiaoyi Wang, Christopher V Rao
University of Illinois at Urbana-Champaign, USA
***Corresponding Email:** santosh.koirala@outlook.com

Abstract:

We investigated the sugar utilization system in *Escherichia coli*. Glucose is known to inhibit the transport and metabolism of many sugars in *E. coli*. This mechanism leads to its preferential consumption. Far less, however, is known about the preferential utilization of non-glucose sugars in *E. coli*. One notable exception is arabinose and xylose. Previous studies have shown that *E. coli* will consume arabinose ahead of xylose. Selective utilization results from arabinose-bound AraC binding to the promoter of the xylose metabolic genes and inhibiting their expression. This mechanisms, however, has not been explored in single cells. Both the arabinose and xylose utilization systems are known to exhibit a bimodal induction response to their cognate sugar, where mixed populations of cells either expressing the metabolic genes or not are observed at intermediate sugar concentrations. This suggests that arabinose can only inhibit xylose metabolism in arabinose-induced cells. To understand how crosstalk between these systems affects their response, we investigated *E. coli* during growth on mixtures of arabinose and xylose at single-cell resolution. Our results show that mixed, multimodal populations of arabinose and xylose-induced cells occur at some intermediate sugar concentrations. We also found that xylose can inhibit the expression of the arabinose metabolic genes and that this repression is due to XylR. We further found that xylose-bound XylR binds to the divergent promoter region of the regulator araC and the arabinose metabolic genes and inhibit expression. These results demonstrate that a strict hierarchy does not exist between arabinose and xylose as previously thought and this may aid in the design of E. coli strains capable of simultaneous sugar consumption.

Keywords: Arabinose, *E. coli*, Xylose

Guest Speaker

Biography: Willem Grimminck

Willem is the founder of One to Watch, one of Nepal's first Fund Managers and a pioneer in Impact Investment in Nepal. He started One to Watch with a vision - to build innovative companies in Nepal, together with Nepali entrepreneurs and impact investors from around the world. Inspired by the wealth of business opportunities in Nepal, Willem has not only been using his own knowledge and expertise to build successful companies, he also actively engages to attract industry knowledge and expertise from other places. Willem understands the potential that lies behind the challenging exterior of the Nepali economy, making him and One to Watch a leader in this industry here in Nepal. One to Watch works with small and medium sized companies focusing on basic needs – food/agri, infrastructure and healthcare, companies that create impact as well as profits. Till date One to Watch has invested in 15 SMEs in Nepal, in the missing middle, investing a total of 54 million Euros, from the pioneer fund Nepal Impact Investment Community-1 (NIIC-1). Through its business acceleration programs, One to Watch has received more than 600 applications and has successfully accelerated more than 40 SMEs in Nepal. The average success rate of the companies accelerated by One to Watch is between 60-70%.

Session IV

AGRICULTURE & PLANT BIOTECHNOLOGY

Abstract Book
ICBB 2020

Chair: Session IV

Agriculture and Plant Biotechnology

Biography: Dr. Bibek Aryal

Bibek Aryal is postdoctoral researcher at Umeå Plant Science Centre, Sweden. Dr. Aryal received his PhD in Molecular Plant Science from University of Fribourg, Switzerland in 2017 with Prof. Markus Geisler. He obtained his Master degree from Technical University of Kaiserslautern, Germany. Before joining Umeå Plant Science Centre his work focuses on phytohormone auxin and its regulation in the context of plant pathogen interaction. During post doc his research focuses on differential cell elongation during apical hook development in Arabidopsis. Dr. Aryal has been co-supervising several Bachelor and Master Projects and published more than 10 research articles in international journals.

Role Of Xyloglucan In Differential Growth During Apical Hook Development In *Arabidopsis* [OP 20]

Aryal B[1,*], J Kristoffer[1], S Gloria[2], Baral A[1], A. L Routier[3], D Kierzkowski[3] and R P. Bhalerao[1]

[1]Umeå Plant Science Centre, Department of Forest Genetics and Plant Physiology, Swedish University of Agricultural Sciences, SE-901 87 Umeå, Sweden,

[2]Department of Biology, ETH Zurich, 8092 Zurich, Switzerland, [3]Plant Biology Research Institute, University of Montreal, Montreal QC H1X 2B2, Canada

***Corresponding E-mail:** aryal_bibek@hotmail.com

Abstract:

Differential cell elongation plays a key role in development. In plants, bending of hypocotyl by differential cell elongation results in apical hook structure that protects the shoot apical meristem as seedling emerges from the soil. The role of hormones in apical hook development is well established but how these mechanistically drive differential growth is not well understood. Since plant cells are enclosed within a cell wall it can be hypothesized that and interplay between hormonal signals and plant cell wall modulation could play a central role in differential cell elongation. Here we present evidence for the role of xyloglucans, a major primary cell wall component in auxin mediated differential cell elongation using apical hook development as an experimental model. Here we show that differential mechanical properties in epidermal cells dependent on xyloglucan, a key primary cell wall component, underpins differential epidermal cell elongation rates essential for hook development. Xyloglucan dependent transcriptional control of polar auxin components PINs and AUX1 is required to generate asymmetric auxin response required for differential cell elongation in hook development. Genetic evidence indicates that auxin response factor ARF2 acts a negative regulator downstream of xyloglucan mediated control of hook development. Whereas auxin dependent modulation of cell wall properties is well known our results now reveal a feedback between cell wall components and transcriptional control of polar auxin transport in differential cell elongation.

Keywords: Differential growth, Cell wall, Auxin, Xyloglucan, Apical hook

Co-chair: Session IV

Agriculture and Plant Biotechnology

Biography: Dr. Namraj Dhami

Namraj Dhami is an Assistant Professor at the School of Health and Allied Sciences, Pokhara University, Nepal (www.pu.edu.np). He obtained PhD in Biochemistry and Cell Biology from Western Sydney University, Australia, MSc Plant Biotechnology from Wageningen University, The Netherlands, and MSc and BSc Botany from Tribhuvan University, Nepal. His expertise is biochemistry, cell, and molecular biology of medicinally and nutritionally important secondary metabolites, particularly carotenoids, in plants. The recent research and scholarly contribution of Dr. Dhami can be found at the Google Scholar link: https://bit.ly/2qYSYzm.

Biography: Dr. Prakash M. Pradhanang

Born and raised in Nepal's one of the most beautiful cities Pokhara, 200 KM west to Kathmandu. High school diploma in Pokhara, undergraduate in Biology/Botany from Tribhuwan University, Kathmandu. Master's and PhD from University of Reading, UK, and Post doc at the University of Florida in Gainesville. He is a professional plant pathologist, considered as one of global leaders on a plant disease called bacterial wilt caused by *Ralstonia solanacearum*. He managed Plant pathology, Entomology, Seed technology, and Soil sciences programs at Lumle Agricultural Centre (LAC) in Nepal and thinks that his tenure at LAC to be the most enjoyable and satisfying period of his life. His research results have been published in several internationally referred journals. Prakash joined Heinz Seed Company-California in 2003 as a Plant pathologist, where he identified disease resistant traits, and managed seed-health testing laboratory. He established a brand new Plant pathology laboratory at LAC and at Heinz facility for disease diagnostics and seed-health testing. Heinz laboratory is accredited by National seed health system (NSHS) administered by Iowa State University. After his 10-year tenure at Heinz-California, he moved to south west Florida to join Lipman family farms in 2013 as Seed production manager. Lipman Co. is the largest fresh market tomato company in the USA. His extensive pathology background and experience of seed-health testing was a great aid to his new role as many diseases can be seed-borne and transmitted through seed trade. The new job took him to Chile, China, India, Peru, and Vietnam and travelled extensively to make hybrid seeds of tomato in these countries. Prakash had been looking to return to his home country after retiring. And finally, he returned home on May 4th 2019. Prakash is happy to be out of vicious rat-race cycle but continues to work as Seed Production consultant to Lipman Co. and manage seed production in Asian countries. As a give back to society, he wishes to help Nepalese Seed Producers to improve seed quality standards and connect with international seed industries.

F1 Hybrid Vegetable Seed Production: Prospects And Challenges

[OP 21]

Prakash M. Pradhanang
Seed Production Consultant, Lipman Family Farms, Estero, Florida
Corresponding E-mail: Prakash.pradhanang@lipmanfamilyfarms.com

Abstract:

Over the past 3 decades, F1 hybrid has replaced open pollinated varieties of many vegetable crops. Product uniformity, higher yield, and disease resistance are the major advantages of hybrid seed varieties. Leading seed industries in the USA and Europe invest profoundly on development of better hybrids to stay profitable and competitive in the market place. Unfortunately due to lack of good male sterility in some of the key vegetables, F1 seed production is cost prohibitive in countries where labor wages are high. China, India, and Thailand are the leading producers of hand pollinated F1 hybrid vegetable seeds in the world. Seed production management in thousands of farmers' fields in these countries is a constant challenge for seed industries and local vendors. Production practices and hybrid purity have improved tremendously over time but parental lines are still vulnerable to predatory practices. Some seed companies have addressed the issue by supplying live pollen at the time of pollination to safe guard male parents but there are logistic issues. Over time, local seed multiplier companies have developed special measures to track parental lines in production fields.

Nepal has been making hybrid tomato seeds for domestic market for the last two decades. However, seed companies with global foot print are not present for seed multiplication despite having diverse topography and agro-ecological zones. In order to attract international seed companies, Nepal needs to comprehend global phytosanitary requirements, develop seed testing and inspection capacity for seed-borne diseases, and develop seed processing infra-structures. Relevant public institutions and private companies should organize workshops to gain better insight of seed production potential and its socio-economic impact in Nepal. In rural areas of Karnataka State of India, hybrid vegetable seed production has aided alleviating poverty of thousands of poor farmers.

Keywords: Vegetable Seeds, F1 Hybrids, Tomato

Biography: Ashok Kumar Bhattarai

Ashok Kumar Bhattarai is the Cofounder and Director of Praramva Biotech Pvt. Ltd. Realizing right after his graduation in Biotechnology from Kathmandu University in 2010, that the employment &/or further research opportunities were meager in the country, yet being adamant on doing something right here in Nepal, he founded Praramva Biotech along with his three friends in 2011. It all started with four friends trying to commercialize vermicompost but somehow that wasn't enough. Their collective dream was to back up their business endeavors with strong research based knowledge and skills and offer unique and viable agro solutions to the market. This led him to become the scholar of the pioneering batch of M. Tech in Biotechnology in Kathmandu University. His research on the study of Biocontrol measures of microbes to combat agricultural pathogens proved to be a turning point as well as on ideator in formulating various microbes-based agri-products, the company has been offering since.

Currently, Mr. Bhattarai is active through his company, in the field of vermicomposting, solid waste management, sustainable organic agriculture practices and urban agriculture. Praramva has been partnered with Nepal Government (Ministry of Agriculture, Kathmandu Metropolitan City) and various NGO's and INGO's in conduction of trainings and hands on workshop to farmers, government officials, academic institutions etc.

Bio Fertilizer: The New Elephant In The Room. [OP 22]

Ashok Kumar Bhattarai

Praramva Biotech Pvt. Ltd., Kathmandu, Nepal

Corresponding E-mail: praramva.biotech@gmail.com; akbhattarai33@gmail.com

Abstract:

Despite of 68% of the population being dependent on agriculture for a livelihood and almost 80% actively participating in it, agribusiness contributes only 41% in Nepalese GDP. Unfortunately this is because an agriculture practice in Nepal has always been taken as means of sustenance rather than being source of income. Hence business oriented agricultural practice is today's need in both microscopic as well as macroscopic view.

But the reality is we are going through all the conventional practices and the implementation of the newer inputs and technologies has always been challenge. To top it off, there are no adequate research on agriculture problems either by government or private academia and even the "experts" knowledge is very archaic.

This session will put light on the current scenario, gap between markets demand and scholars work, policy gap and different business opportunities one can explore in agriculture in Nepal.

Keywords: Biofertilizer, Bioinsecticides, Biopesticides, Decomposer, Vermicompost

Biography: Manish Baral

Manish is presently working at Research Institute for Bioscience and Biotechnology (RIBB) as Research associate from September 1, 2018. He has received B.Sc. in Biology (2011) from The University of Texas at Arlington, Texas, USA and M.Sc. degree in Agriculture (in tropics and subtropics) from University of Hohenheim, Stuttgart, Germany in 2017. He is mostly interested to fortify iron and zinc in plants and identify the molecular mechanism behind it. Accordingly, he is working to biofortify wheat for improved yield and to reduce micronutrient deficiencies in Nepalese population. He had previously worked as research assistant in Eurofins Agrosciences services Ecotox GmbH, located in Germany.

Green Synthesis Of ZnO Nanoparticles Using Wheat Extracts: Characterization To Physiological Effects On Wheat Germination

[OP 23]

Manish Baral[1], Rajina Shrestha[1,2], Mitesh Shrestha[1,*]

[1]Research Institute for Bioscience and Biotechnology (RIBB), Kathmandu, Nepal

[2]National College, Kathmandu, Nepal

***Corresponding E-mail:** shresthamitesh@gmail.com

Abstract:

Wheat is the staple food of Nepal, however, low availability of zinc in the soil of various regions of Nepal has resulted in zinc deficit grains. This has received great attention in recent times due to the increase in stunted growth, lowered immunity and anaemic conditions especially among children. To address the threatening issue, this project aimed to explore novel, cost effective and eco-friendly approach for synthesising zinc oxide nanoparticles from water extract of different wheat varieties *(WK 1712, WK 1204 and Chyakhura)* and its plant parts (seeds, seedlings and sprout) to use it as a zinc fertilizer in wheat. Nanoparticles synthesized showed the characteristic peak at 350 nm under UV-VIS spectrophotometer. The purpose of first part of the project was to visualize the effects on various germination parameters of *WK1204* wheat variety by nanoparticles as compared to zinc sulphate. Using germination test as a parameter, none of the nanoparticles showed toxicity as compared to water as control. In fact, nanoparticles synthesized from *Chyakhura* seedling, at 125 ppm showed significantly better vitality index for seeds compared to both water and high concentration (25000 ppm) of respective plant extracts. The index for nanoparticles at 125 ppm (*Chyakhura* seedling and *WK 1204* Sprout) was comparable to the zinc sulphate at 500 ppm, surmising that even lower concentrations of Zinc nanoparticles would be better than higher concentrations of conventionally used zinc sulphate. Hence, it could be inferred that Zinc nanoparticles could be the greener and safer alternative for Zinc supplementation to wheat.

Keywords: Zinc Oxide Nanoparticles, Wheat, Germination, Vitality Index

Biography: Prabesh Shrestha

Prabesh Shrestha is the co-founder of Sarba Shrestha Seeds Pvt. Ltd. and working as Managing Director. After completing his Masters in Biotechnology from Bangalore University (Bangalore) in 2014, despite being offered for PhD, he left the offer and came back to Nepal with the interest to work in agriculture sector. With the continuous discussions and advice from Nepalese Plant breeder working internationally, he founded Sarba Shrestha Seeds with other two fresh graduates and started working in Plant Breeding Research in developing new vegetable hybrid varieties itself in Nepal which is the first of its kind. He thought management degree would add value to his business and later he did eMBA from Purwanchal University. He has also done short course on Seed Sector Development from Wageningen University (Netherland). He works very closely with farmers and satisfies them with provision of quality vegetable seeds.

Sarba Shrestha Seeds (SSS) is working with the mission to provide quality seeds to Nepalese farmers and has been producing its own hybrid vegetable seeds with its own R & D. Sarba Shrestha Seeds has collaborated internationally with John Innes Centre, UK for transforming seed researches into industry.

Seed Business In Nepal [OP 24]

Prabesh Shrestha
Founder, MD
Sarba Shrestha Seeds Pvt. Ltd., Kathmandu, Nepal
Corresponding E-mail: bt.prabesh@gmail.com

Abstract:

More than 90% of the hybrid seeds are imported. Nepal has varying geography with altitude ranging from 60m asl to Everest. With the proper use of different geographical areas, SSS aims to develop varieties in Nepal with the motto "Seeds from Nepal, Seeds for Nepal". We feel there is no authentic data on agriculture sector except on import and export. If we had as many farmers as per data, there would not be trade deficit in various agriculture sectors.

- The talk will be focused on:
- Fascinating data on seed industry in Nepal
- Transforming Book knowledge to industry
- Exploring Biotechnology applications in Agriculture Sector

Keywords: Hybrid seeds, Nepal

Biography: Mr. Kishun Ghalan

Kishun Ghalan is the CEO and Founder of Kalapas Biotech Pvt. Ltd. As an entrepreneur, a traveller and an enthusiastic researcher, his research fields align with Agriculture, Microbiology, Biochemistry, Plant Tissue culture and Nanotechnology. He believes in creating opportunities by bridging research and environment. With vision of creating independent private research institute to work on various research sectors to uplift Nepal's agriculture, he founded Kalapas Biotech which is currently working on production of robust commercially viable plants using Tissue culture technology and also initiated to introduce local seedlings to international market. In addition, Kishun participated in the U.S. government funded "Professional Fellows Program for Economic Empowerment" and is a U.S. government alumnus.

Entrepreneurship And Plant Tissue Culture [OP 25]

Kishun Ghalan
Founder, CEO
Kalapas Biotech Pvt. Ltd., Kathmandu, Nepal
Corresponding E-mail: kishun@kalapasbiotech.com

Abstract:

In Nepal, there is a lack of substantial to uplift agricultural sector despite immense opportunities. The vision to bridge this gap gave birth to Kalapas Biotech. Establishing a biotech company and making it commercially successful is a big challenge in a developing country where there is lack of proper policy to facilitate agriculture. However, with continuous dedication and motivation, Kalapas Biotech has expanded from three to 28 people in a short period of time. With expertise in Plant tissue culture, cold storage, drip irrigation, precision farming, hydroponic, and aquaponics, the team is motivated to support a younger generation of farmers to get involved in agriculture leaving the traditional methods behind.

Keywords: Kalapas Biotech, Tissue culture, Entrepreneurship

POSTER PRESENTERS

Value Addition Of Citrus Fruit Peels By Extraction Of High - Value Bioactive Compounds Via Hydrodistillation, Green Extraction And Solid State Fermentation [PP 01]

Aatish Mali, Angisha Basnet, Yogesh Joshi, Prativa Pandey*
Research Institute for Bioscience and Biotechnology (RIBB), Kathmandu, Nepal
***Corresponding E-mail**: pprativa1@gmail.com

Abstract:

Food waste is a major global problem which accounts for about 45% of fruit and vegetable losses. Among the overall fruit production in Nepal, citrus fruits contribute to about 37% among which approximately 15% are wasted. In the present study, three different citrus fruit peels (orange, sweet orange and lemon) collected from around Kathmandu valley were used for essential oil (EO) production, green extraction and solid state fermentation. In essential oil production via hydrodistillation, the yields were optimized using different pretreatment methods and their compositions were determined. The yield increased up to 5 times when steam explosion pretreatment was introduced in orange peels. The composition of EOs analyzed by gas-chromatography mass spectroscopy (GC-MS) showed limonene as a major bioactive compound in all three species constituting up to 96% in sweet orange. Similarly, Total Phenolic Content (TPC) analysis of extracts showed up to 6.5 times higher value in orange peels compared to lemon peels when water was used as solvent and Total Flavonoid Content (TFC) analysis showed similar values for both peels. The DPPH assay to determine antioxidant properties exhibited highest free-radical scavenging capacity of 71% for orange water extract. Similarly, *Aspergillus niger* fungi isolated from spoiled fruits was used as an inoculum to extract calcium citrate, oxalic acid and gypsum using orange, sweet orange and lemon as substrate and solid state as a fermentation technique.

Keywords: Essential oil, Food waste, Green extraction, Solid state fermentation, Value addition.

Effect Of Carbon And Nitrogen Sources On Biomass And Protein Productivity In Microalgae [PP 02]

Anish Ghimire*, Biden Bade, Nabin Giri, Bivek KC, Suman KC

Department of Biotechnology, Kathmandu University, Kavre, Nepal

***Corresponding E-mail:** anish.ghimire120@gmail.com

Abstract:

Microalgae has attracted considerate interest throughout the world due to its substantial potential application in feed industry, biopharmaceuticals etc. Understanding the importance, many interventions are being approached in different research entities throughout the world for culturing of protein rich microalgae while the cost of production remains expensive. In contrast, the application of microalgae is yet to be exploited in Nepal and concerning the economic status of the country, an alternative way for inexpensive production of microalgae seems feasible. So, this project is conducted with the aim to screen and generate a cost-effective media that comprises fresh water and alternative nutrient sources for high-density culture of protein-rich microalgae in pilot-scale bioreactor. For the study, isolated microalgae strain was obtained from laboratory and further cultured in medium supplemented with different Carbon and Nitrogen sources at varying concentration. Different concentration of Sodium Bicarbonate and Calcium carbonate were used as carbon source. Likewise, different concentrations of Urea, NPK and DAP were used as Nitrogen source for growth of microalgae. For the source of micronutrient, pre-treated Soil extract was used. Different parameters like specific growth rate, Dry Biomass, Biomass productivity and Protein productivity were estimated. As a result, media supplemented with Sodium Bicarbonate (1 g/L) as a carbon source showed maximum specific growth rate (μ) of 0.02093 hr-1 and biomass productivity of 0.067g/L/day. Similarly, media supplemented with Urea (500 mg/L) as a nitrogen source showed maximum protein productivity and yield of 1.21×10-2g/L/day and 28.25±1% respectively. Hence, Sodium bicarbonate (1g/L) and Urea (500mg/L) were selected and mixed in tap water along with Soil extract (1:10 volume) in 100L photo bioreactor for culture of microalgae. Then the final dry biomass of 0.833 g/L, Protein yield of 47.5±2% and Protein productivity of 4.3×10-2g/L/day was obtained which was comparatively higher. Thus, the study opened a door to devising a low-cost medium for culturing of microalgae posing a vital application in feed industry in context of Nepal.

Keywords: Biomass, Carbon sources, Low-cost production, Microalgae, Nitrogen sources, Protein

Evaluation Of Phytochemical And Antioxidant Activities Of Selected Medicinal Plants Of Nepal [PP 03]

Anita Dahal, Atisammodavardhana Kaundinnyayana*
School of Health and Allied Sciences, Pokhara University, Pokhara-30, Kaski, Nepal
***Corresponding E-mail:** atis@pu.edu.np

Abstract:

Traditional herbal medicine has often been used for multifarious reasons like historical, cultural, and ecological, particularly it owing to continued availability, better compatibility and high acceptance. Thus, Nepalese herbs with ethno-medicinal properties are being screened for their active pharmacological effects. The ethanolic extract of selected medicinal plants i.e. *Bergenia pacumbis and Selinum wallichianum* from Mustang district were subjected for preliminary phytochemical screening by standard protocal, quantitative analysis of total flavonoids content from aluminium chloride colorimetric method total phenolic content was determined by Folin-Ciocalteu method and in-vitro antioxidant assay by DPPH radical scavenging method. The ethanolic extract of *Bergenia pacumbis* showed the presence of flavonoids, tannins and carbohydrate with high phenol content i.e. 152.76±11.86 µg GAE/mg dry weight of extract, total flavonoid content 1.05± 0.03mg QE/mg dry weight of extract and it also has the higher antioxidant activity with IC50 value 5.13µg/ml using standard ascorbic acid with IC50 value 5.32 µg/ml. From the above result *Bergenia pacumbis* exhibits potent antioxidant along with high phenol and flavonoid content. This study supports its traditional use and which might be helpful for discovery of natural antioxidant. Further investigation is recommended for the other pharmacological activities of the samples.

Keywords: Phytochemical Activity, Antioxidant Activity, Nepalese Medicinal Plants

Analysis Of Iron Content In Selected Vegetarian Food Items In Pokhara [PP 04]

Ankit BK[1], Anup Subedi[1], Samrat Subedi[1], Kushal KC[1], Bishal Gautam[1], Damodar Koirala[2,*]

[1]Department of Chemistry, Tribhuvan University, Pokhara Metropolitan City, Kaski

[2]School of Engineering, Pokhara University, Pokhara Metropolitan City, Kaski

***Corresponding E-mail:** koirala2059@gmail.com

Abstract:

Analysis of iron content of 10 vegetarian food samples belonging to three different food (spices, lentils and locally available vegetables) categories was the objective of this study. UV-Vis spectrophotometry was used to estimate and evaluate the levels of iron in the studied vegetables, lentils and spices. Vegetarians are more vulnerable to the deficiency of iron as they consume non-heme iron which needs to be altered before it can be absorbed by the body. While, non-vegetarians are rarely a victim of iron deficiency as their diet consists of meat through which they consume proteins like hemoglobin and myoglobin directly in the unaltered form. Inevitably, there is a need to measure the amount of iron in the vegetarian food products to determine which food sources are rich in iron, so that they may be consumed during iron deficiency. Spectrophotometric technique of analysis was used to determine the iron content. It works on principle of the Beer-Lambert law. From the results thus obtained, the maximum contribution was shown by spices and condiments towards the dietary iron content whereas the minimum contribution was shown by vegetables and lentils.

Keywords: Beer-Lambert law, Iron content, Vegetables

Effects Of Sucrose Concentrations On Bioactive, Physiochemical And Sensory Properties Of Sweet Orange Peel Candy [PP 05]

Anushuya Guragain
Golden Gate International College, Kathmandu, Nepal
Corresponding E-mail: anushuyaguragain@gmail.com

Abstract:

The aim of the research was to prepare candy of sweet orange peel by dipping in three different sucrose concentrations of final 30%(C30), 40%(C40) and 50%(C50) and by drying it in cabinet drier (60ºC for 8 hrs). The peels were initially hot-water blanched in the ratio 3:1 (water: peel) at 90ºC for 1 minute containing 5% of citric acid which was then dipped in sucrose concentration in the ratio 2:1 (sucrose solution: peel) for consecutive 4 days. Experiments were carried out to determine the physiochemical and bioactive components of peel and candy along with the sensory evaluation of candy. The data were analyzed by independent sample t-test for peel and blanched peel, one-way Analysis of variance (ANOVA) for candy and Kramer's table for sensory evaluation. The retention of phenolic content, tannin, flavonoid, carotenoids and antioxidant in hot water blanched peel was found to be 75.93%, 50.58%, 75.13%, 125.12% and 99.27% respectively. Reducing sugar and total sugar were found to be higher in unblanched peel than hot-water blanched peel. From the analysis, the candy prepared from syrup concentration of 30% was found to have higher bioactive compounds. The retention of phenolic content, tannin, flavonoid, carotenoids and antioxidant in C30 was found to be 11.57%, 48.25%, 39.51%, 38.32% and 79.09% respectively. C30 was found to have higher crude fiber and total ash than C40 and C50. It was found that there was significant effect of sucrose concentrations on physiochemical, bioactive and all sensory attributes of candy. This completes the preparation of candy in variation of sucrose concentration with substantial amount of bioactive compounds.

Keywords: Orange peel, Sucrose, ANOVA

Miniaturized Nanophotonic Optical Coherence Tomography System For Endoscopy [PP 06]

Rijan Maharjan[1], Sanket Bohora[1], Pravin Bhattarai[1], Gopal Lama[1], Richard Hogg[2], David Childs[2], Richard Curry[3], Iain Crowe[3], and Ashim Dhakal[1,*]

[1]Biophotonics Lab, Phutung Research Institute, PO Box 12335, Goldhunga, Tarakeshor-5, Kathmandu, Nepal

[2]Electronics and Nanoscale Engineering, University of Glasgow, Glasgow G12 8QQ, UK

[3]Photon Science Institute, University of Manchester, Manchester M13 9PL, UK

***Corresponding E-mail:** ad@pinstitute.org

Abstract:

A Photonic Integrated Circuit (PIC) integrates different optical components needed for an optical functionality in a very tiny-chip made on a single substrate, thereby making them compact, smaller, efficient and cheaper. The idea is similar to integration in electronics, which has been the major driver of the current technological advancements. Recent developments in PIC technology has enabled basic building blocks for all integrated optical coherence tomography (OCT) based imaging system on a PIC, that is compatible for fabrication using the standard CMOS electronics foundries. These devices include, among other things, on-chip light sources (lasers, super-luminescent light emitting diodes, etc), detectors, modulators (devices that manipulate light intensity), interferometers (devices that uses interference of light to detect changes in optical properties in a sample), couplers (devices that injects light into a chip or, out of the chip), etc. The prospect of 'on-chip' OCT will have important consequences in diagnostics, particularly in endoscopy. One example is diagnosis of early stages of Chronic Obstructive Pulmonary Disease (COPD), one of the major health problems in Nepal, as well as in the globe. The combination of high resolution offered by OCT, along with low cost of mass-fabrication in a CMOS foundry implies that it can be a panacea for applications in the developing world, where the installation, maintenance and operation cost of high resolution imaging techniques such as x-ray-based CT-scan is a serious limiting factor. Here, we propose delivering such an on-chip OCT device via a standard bronchoscope, identifying the major requirements of such a device for early stage diagnosis and progress monitoring of COPD, and determining the major advantages and limitations of such approach. The dream to realize an all-integrated silicon chip for OCT applications is hindered by few major bottlenecks, such as, (a) lack of efficient and aberration-free couplers to focus light from the chip to the tissue and to collect the light from the tissue to the chip, and (b) compact high resolution spectrometers. We present progress we have made in our efforts to address these issues.

Keywords: Endoscopy, Integrated photonics, Integrated spectrometers, Optical coherence tomography, Photonic integrated circuits, Silicon photonics

Antibiogram For Bacteria Isolated From Fresh Fruits And Vegetables

[PP 07]

Ashish Bhusal[1, 2], Jenny Shah[1, 2,] Bishnu Marasini[2], Mitesh Shrestha[1,*]

[1]Research Institute for Bioscience and Biotechnology, Kathmandu, Nepal

[2]National College, Khusibu, Kathmandu, Nepal

***Corresponding E-mail:** shresthamitesh@gmail.com

Abstract:

Bacterial resistance to antibiotics has become a major public health issue worldwide. Fruits and vegetables constitute an important food group that has been linked to maintenance of well-being of individuals due to their nutritional value, however, they can also harbor potential pathogenic bacteria. The aim of this study was to perform antibiotic susceptibility testing for bacteria isolated from fruits and vegetables sold at various market places in Kathmandu. Carrot (from Lagakhel); Guava and Beetroot (Koteshwor) and Apple (Balkhu) were collected and washed separately with the Maximum Recovery Diluent (MRD) and incubated for 4 hours at 37. After the incubation, 1 ml of MRD was taken and serially diluted followed by culture on Nutrient Agar plates. In total, 25 bacteria were isolated and identified by staining and different biochemical tests. Antimicrobial Susceptibility Test (AST) by disc diffusion method was carried out for the bacteria as per the CLSI guidelines. Bacteria from Apple were found to be resistant to Amoxyclav (AMC), Ceftriaxone (CTR), Co-Trimoxazole (COT), Cefotaxime (CTX) and Polymyxin-B (PB). The bacteria isolated from Guava were resistant against CTR, PB, AMC, COT and CTX while that from Beetroot were resistant against Imipenem (IMP), Piperacillin/Tazobactam (PIT), CTR, PB, AMC, COT, and CTX. Similarly, bacteria isolated from Carrot had resistance against CTR, Piperacillin (PI), CTX, PB and Nitrofurantoin (NIT). Hence, our study concludes that the bacteria present in fruits and vegetables carrying resistance to many of the antibiotics could pose a potential public health threat.

Keywords: Antibiotic Resistance, Antimicrobial Susceptibility Test (AST), Fruits and Vegetables

Complete Edentulism: A Cause Of Nutritional Deficiency In Elderly Women - A Randomized Controlled Trial [PP 08]

Balendra Pratap Singh[1,*], Divya Mehrotra[1], Sumit Kumar[1], Kapila Kumar[1], Abbas Ali Mahdi[1], Nishi Singh[2]

[1]King George's Medical University, Lucknow

[2]Purvanchal Institute of Dental Sciences, Gorakhpur

***Corresponding E-mail:** balendrapratapsingh@kgmcindia.edu

Abstract:

Objective of this study was to evaluate the role of complete denture fabrication in improving the nutritional status and masticatory efficiency in elderly women as well as role of dietary supplements on nutritional status. This randomized controlled trial was conducted from 2012 to 2016 in tertiary care institution and patients were recruited after taking written consent form. This study included 126 cases (complete edentulous) and 63 control (complete dentition) participants. Inclusion criteria were female from 45-65 yrs, class I complete edentulous (2-6 months) with no history of dental wearing for case group and class I complete dentition occlusion for control group. Exclusion criteria were any metabolic disease/malignancy, osteoporosis, taking any food supplement. Various biochemical (hemoglobin, calcium, albumin, and vitamin D), masticatory efficiency & radiological investigations were conducted. Case group divided into equal size group into with and without food supplement after rehabilitation with complete denture. All the investigations would be repeated 3 and 6 months after fabrication of the denture and dietary supplementation. Level of significance was set as 0.05 and SPSS version 21 was used to analyse the study. A statistically significant difference was found in biochemical parameters after rehabilitation with complete denture before and after complete denture fabrication. (P<.05) Statistically no difference was noted between complete denture wearer with or without taking nutritional supplements on biochemical parameters, masticatory efficiency. This study find that complete denture itself enhance masticatory efficiency which may increase patient choices of food taken. So this study do not find food supplement to added benefit after rehabilitation with complete denture.

Keywords: Edentulism, Elderly Women, Nutritional deficiency

First Genotype Identification of *Orientia Tsutsugamushi* from Nepal [PP 09]

Binod Rayamajhee[1,*], Ram Deo Pandit[2], Pardip Oli[3], Sagar Aryal[1], Gaurav Karki[1], Anurag Adhikari[1]

[1]Kathmandu Research Institute for Biological Sciences, Lalitpur, Nepal

[2]Ayurveda Campus, TU, Kritipur, Kathmandu, Nepal

[3]Sagarmatha Diagnostic Lab and Polyclinic, Nepalgunj, Banke, Nepal

***Corresponding E-mail:** rayamajheebinod@gmail.com

Abstract:

A retrospective cross-sectional study was done to identify the genotype of circulating *Orientia tsutsugamushi* during the 2015 earthquake, using acute-phase sera and buffy coats of the patients (n=40). Nested polymerase chain reaction (N-PCR) and real-time quantitative PCR (Q-PCR) were performed to amplify O. *tsutsugamushi* 47-kDa gene for nucleotide sequencing using Sanger method. Out of forty isolates, only four were amplified for 47-kDa gene, and among them, three were close to Karp strain (98-99% homology), and one was 100% homologous to Boryong strain. We show for the first time, that the Karp and Boryong strains are circulating in Nepal. Further expansion of genotype or serotype screening in patients and rodents will be necessary to establish a true representation of the strains that are prevalent in the region.

Keywords: *Orientia tsutsumagushi*, Phylogeny, Scrub typhus

Molecular Characterization Of The Biofilm Generating Population Of Multidrug Resistant Escherichia Coli Isolates [PP 10]

Upasana Shrestha[1], Prakat Neupane[2], Shrisha Thapa[2], Rojina Kalakheti[2], Himal Chhetri[2], Kushal Koirala[1], Pratistha Kandel[1], Astha Tuladhar[1], Shyam Kumar Mishra[3], **Bivek Timalsina**[1, *]

[1]Center for Health and Disease Studies – Nepal (CHDS), Shankhamul, Kathmandu, Nepal

[2]SANN International College, Purbanchal University, Kathmandu, Nepal

[3]Department of Microbiology, Institute of Medicine, Tribhuvan University Teaching Hospital, Maharajgunj, Kathmandu, Nepal

***Corresponding E-mail:** btimalsina@chdsnepal.org

Abstract:

Biofilm refers to microbial derived sessile community consisting of cells that are attached to a substratum, interface or to each other and are embedded in Extracellular Polymeric matrix. Biofilm is associated with several human infections and cancers. It serves as a mean for self-defense of bacteria, resisting physical forces and hindering penetration of antibiotics. Due to the intrinsic resistance of biofilm to antibiotics and host defense system, biofilm associated diseases are challenging to be treated effectively. In this study, we examined the association between the presence of biofilm and multi drugs resistance in drug resistant *E. coli* strains isolated from urine samples of patients with urinary tract infections (UTI). Furthermore, we performed the molecular studies to test the presence of known biofilm associated genes, *pgaA, pgaB and pgaC* of the isolates. UTI is the most reported infection associated with *E. coli* affecting primarily females and children in Nepal. Treatment of the infection is becoming complex due to increasing drug resistance. Therefore, it is crucial to understand the mechanism for drugs resistance of *E. coli* isolated from urine samples. We hypothesized that biofilm associated genes might be one of the reasons for drugs resistance in these samples. This prospective study was conducted at Center of Health and Disease Studies – Nepal (CHDS), Shankhamul, Kathmandu over 4 months period to a) detect biofilm formation, b) correlation between biofilm formation and anti-microbial resistance of isolates, c) characterize biofilm associated genes as mentioned above and d) relate effect of biofilm related genes to corresponding biofilm formation ability.

Sixty-six multi drug resistant *E. coli* isolates were collected from different hospitals. Isolates were resistant to 8 out of 15 antibiotics tested, binning them as multi-drugs resistant isolates. Assessment by Tube Adherent and Tissue Culture Plate methods for

biofilm production showed 61% of the isolates as biofilm positive. Interestingly, analysis for correlation between biofilm production and drugs resistance showed that 39% of biofilm negative isolates exhibited resistance to 41.10% of total classes of antibiotics, respectively, suggesting the limited correlation between biofilm production and drugs resistance. Moreover, molecular characterization of biofilm related genes: *pgaA, pgaB and pgaC* showed that 89.4% of the isolates consisted either one, two, or all three genes, indicating strong association between these genes and biofilm formation. Overall, our study shows insignificant correlation between biofilm production and drug resistance in multi-drugs resistant E. coli isolated from urine samples of UTI patients, and presence of *pgaA, pgaB and pgaC* genes can determine their biofilm forming ability.

Keywords: Biofilm, *E. coli*, Multidrug Resistance, pgaABCD operon, Urinary tract infection

Mycochemical Analysis And Antioxidant Activity Of Some Wild Mushrooms Collected From Matatirtha And Chandragiri [PP 11]

Devchandra Khadka[1,2], Bishnu Marasini[2], Jay Kant Raut[3], Mitesh Shrestha[1,*]

[1]Research Institute for Bioscience and Biotechnology, Kathmandu, Nepal

[2]National College, Khusibu, Kathmandu, Nepal

[3]Nepal Academy of Science and Technology, Khumaltar, Kathmandu, Nepal

***Corresponding E-mail:** shresthamitesh@gmail.com

Abstract:

Wild mushrooms are the source of different bioactive compounds and secondary metabolites which have the potential therapeutic values. In the context of Nepal, the research on wild mushrooms is limited despite its rich biodiversity. The aim of this study was to perform in-vitro examination of the randomly collected wild mushrooms from Matatirtha and Chandragiri. Mushroom identification was done on the basis of its morphology and the substrate where it was found to be growing. The mushrooms identified were *Scleroderma spp., Coltricia spp., Russula spp., Russula spp. and Boletus spp*. Methanol extracts were prepared using 80 % methanol and the solvent was reduced using rotavapor. The antioxidant activity was determined by DPPH (1, 1-diphenyl-2-picrylhydrazyl radical) scavenging method. Total Phenolic Content (TPC) and Total Flavonoid Content (TFC) were also measured. Different concentrations (25 µg, 50 µg, 100 µg and 200 µg) of methanol extracts for each mushrooms were taken and DPPH scavenging activity was shown maximum at 200 µg for *Boletus spp. (78.28%), Scleroderma spp. (56.20%)*, and *Coltricia spp. (54.43%)*. The TPC and TFC of mushroom extracts were calculated and found to be high in *Scleroderma spp*. (89.88 mg/g Gallic acid equivalent) and in *Russula spp*. (6.25 mg/g Quercetin equivalent) respectively. Preliminary analysis leads us to conclude that mushroom species collected could become a potential source of compounds with therapeutic importance.

Keywords: Antioxidants, Mushrooms, Mycochemicals

Phytochemical Screening, Antioxidant And Antimicrobial Activity Of Selected Medicinal Plants. [PP 12]

Divya Sapkota, Swastika Thapa, Samrat Thapa, Rajan Thapa, Bishnu Maya K.C., Janardan Lamichhane*

Department of Biotechnology, Kathmandu University, Dhulikhel, Nepal

***Corresponding E-mail:** ljanardan@ku.edu.np

Abstract:

Five medicinal plants viz. *Hypericum cordifolium Choisy, Lyonia ovalifolia (Wall.) Drude, Osbeckia nepalensis Hook., Rhus javanica L. and Solanum virginianum L*. obtained from Kritipur foothill of Nepal at an altitude of 1400m were found with prominent antimicrobial and antioxidant activity. Antimicrobial and antioxidant activity was evaluated using Zone of Inhibition (ZOI) method, DPPH free radical method and FRAP assay respectively. Among these plants, *O. nepalensis* showed highest antioxidant activity (IC50 for its bud, stem and leaves were found to be 74.11µg/ml, 98.5µg/ml and 93.65µg/ml respectively) followed by *H. cordifolium* (IC50 for its flower, leaves and stem were found to be 112.02 µg/ml, 112.96 µg/ml and 132.57 µg/ml respectively). Highest antimicrobial activity was shown by R. javanica (11.5 mm against *Staphylococcus aureus*, 11mm against *Enterococcus faecalis*, 11 mm against *Salmonella enteritidis*, 10mm against *Pseudomonas sp*., and 9.5mm against *Bacillus sp*.).This data indicates the activities of various phytochemicals identified in phytochemical screening. Further research is continued to analyze the genetic effect of these plants to produce secondary metabolites.

Keywords: Phytochemicals, antioxidant, antimicrobial, ZOI, IC_{50}

Aphicidal Activity Of *Bacillus Thuringiensis* [PP 13]

Jenny Shah[1,2] , Bishnu Marasini[2], MiteshShrestha[1,*]

[1]Research Institute for Bioscience and Biotechnology, Kathmandu, Nepal

[2]National College, Khusibu, Kathmandu, Nepal

***Corresponding E-mail:** shresthamitesh@gmail.com

Abstract:

Bacillus thuringiensis (Bt) is a unique bacterium in that it sharesa common property with a number of chemical compounds whichare used commercially to control insects important to agricultureand public health. *B. thuringiensis* can be taken as an important, effective, reliable form of bio-pesticide. It synthesizes crystalline proteins, cry and cyt that are useful as biological insectides and for developing insect-resistant genetically modified crops. Aphids are among major pests that cause harm to plants. About 15% loss on agricultural yield is caused annually by aphids or insect pests around the globe. Soil samples were collected from different locations for *B. thuringiensis isolation*. Individual colonies with a matt texture was examined microscopically for the characteristic spores and crystals of *B. thuringiensis*.Colony characteristics, gram staining, spore staining, Amido Black staining and biochemical tests were performedfor confirmation of *B. thuringiensis*.Aphicidal assay was done on aphids *(Myzuspersicae)* found in green mustard leaves where the isolated bacterium showed 70% mortality when compared to the control. Hence, the isolated *B. thuringiensis* could be of great importance in controlling aphid damage in mustard green leaves.

Keywords: Aphids, *Bacillus thuringiensis*, Cry proteins

Secondary Metabolites From The Endophytic Fungus *Plectosphaerella Cucumerina* Isolated From The Plant *Urtica Dioica* L. (Sisno) [PP 14]

Keshab Bhattarai*, Harald Gross

University of Tübingen, Pharmaceutical Institute, Department of Pharmaceutical Biology, 72076, Tübingen, Germany

***Corresponding E-mail:** keshabbhattarai05@gmail.com

Abstract:

Fungal secondary metabolites have immensely contributed towards human medicine. Over the past decade, also endophytic fungi are recognized as a potent source for structurally diverse and bioactive natural products. *Urtica dioica*, also known as 'stinging nettle', is a herbaceous flowering plant native to temperate Asia, Europe and western North Africa, possessing a traditional medicinal value. In a preliminary screening attempt of this plant, supported by Center for Natural and Applied Science (CENAS), the endophytic fungus *Plectosphaerella cucumerina* was isolated and subsequently identified by the Belgian Co-orientated Collection of Microorganisms (BCCM). Since *Plectosphaerella* represents an underexplored genus for fungal secondary metabolites, we embarked on the chemical investigation of this fungus.

Here, we report the NMR- and MS-based characterization of the compound dimerum acid as the major product produced by this fungus. Using a metabolomics approach, further analogues of this compound class along with several other putative compounds are currently isolated, which supports our hypothesis that this fungal genus represents a rich source for new natural products.

Keywords: Fungal secondary metabolites, endophytes, metabolomics, spectroscopic tools

Screening Of β-Galactosidase Production From Lactic Acid Bacteria Isolated From Different Livestock Of Nepal [PP 15]

Manila Poudel[1, 2], Rukusha Maharjan[1], Prajwal Rajbhandari[1], Shyam Suwal[3,*]

[1]Research Institute for Bioscience and Biotechnology, Kathmandu, Nepal

[2]National College, Khusibu, Kathmandu, Nepal

[3]Arla Innovation Center, Arla Foods, Aarhus, Denmark

***Corresponding E-mail:** sksuwal@gmail.com

Abstract:

Dairy industry is one of the most dynamic sectors of Nepal where production of cheese and its market is in constant growth. As a starter for the production of dairy products, Gram-positive Lactic acid bacteria (LAB) are generally regarded as safe(GRAS). In addition,some of the LAB can produce β–galactosidase (β–GAL) that are responsible for the breakdown of lactose into its simpler forms and form galactooligosaccharides (GOS). A large quantity of cheese whey produced as a byproduct from the dairy processing consists of lactose (80-85% dry mass) which can be fermented by the β–GAL into GOS. GOS are prebiotic compounds that enhance the performance and function of gut microflora and further improving human health. The main purpose of this study is to isolate industrially useful lactic acid bacteria(LAB) producing β-GAL enzyme from milk of various livestock found in varying altitude of Nepal. The milk samples were collected from various livestock (cow,buffalo and goat) of different altitudes (Bishnupurkatti-80m, Sindhuli-1273m, Khokana-1450m and Chitlang-1750m)of Nepal. LAB present in milk were isolated on selective media (MRS agar for *Lactobacillus spp*. and M17 agar for *Lactococcus spp*.). A total of 85 bacteria isolated from samples were identified via morphological and biochemical characterization. Among the isolates, 40 LAB strains were screened for β-GAL production by using X-gal/IPTG assay which showed blue colonies.

Keywords: Lactic acid bacteria, β-galactosidase, Galactooligosaccharides, Altitude variation, Cheese whey, Prebiotics

Weed Management: Green Synthesis Of Silver Nanoparticles Using *Amaranthus Spp*. Extract And Evaluating Its Anti-Bacterial Activities

[PP 16]

Rita Majhi, Yogesh Joshi, Manish Baral*

Research Institute for Bioscience and Biotechnology (RIBB), Kathmandu, Nepal

***Corresponding E-mail:** baralmanish123@gmail.com

Abstract:

The common summer annual weed of *Amaranthus* species are prevalent in almost every agricultural field (especially in the hot and dry area) as well as in the areas close to roads. These noxious weeds not only deteriorate the beauty of the highway, but it also spreads seeds at large amount to create several health hazards. Furthermore, these weeds directly affect the yield parameters of crops and billions of dollars are being invested in order to manage these weeds which often involves chemical herbicides. In order to address this issue, this project tried to manage and valorize those devastating weeds by using the extract in an ecofriendly manner to synthesize silver nanoparticles. Microwave assisted extraction was performed from aerial parts of *Amaranthus* which was mixed with equal volume of different concentration of silver nitrate (1mM, 3mM and 5mM). Interestingly, extract containing 5 mM of $AgNO_3$ showed change in color as well as characteristic peak at 420 nm in UV-VIS Spectrophotomer confirming the formation of silver nanoparticles. Furthermore, silver nanoparticles dispersed in extract showed inhibitory action against *Escherichia coli* and *Staphylococcus aureus* which could be further utilized for medical purposes.

Keywords: Silver Nanoparticle, *Amaranthus,* Microwave, Valorize

Antioxidant And Mushroom Tyrosinase Inhibitory Activities Of Selected Medicinal Plants Found In Nepal [PP 17]

Manoj Pandit, Rashmi Thapa, Kalpana Parajuli*

School Of Health And Allied Sciences, Faculty Of Health Sciences, Pokhara University, Pokhara-30, Kaski, Nepal

***Corresponding E-mail:** kalpanaprjl@gmail.com

Abstract:

Hyperpigmentation is a common skin problem, which is mostly prevalent in middle aged and elderly individual. Cosmetically, it has great implication as it detracts individual from both appearance and quality of life. Depigmenting agents are the one that help in lightening the skin through various mechanisms. The UV exposure of skin also results in significant oxidative stress via the generation of reactive oxygen and nitrogen species. Natural antioxidants play a significant role in protection against oxidative stress. The main aim of this study was to investigate antioxidant and mushroom tyrosinase inhibitory activity of selected medicinal plants found in Nepal. Ethanolic extracts (70%) of four plants; *Malus domestica* (pulp and peel), *Actinidia deliciosa* (pulp and peel), *Asparagus racemosus* (young shoots), and *Solanum tuberosum* (pulp and peel) were evaluated for their antioxidant activity using 1,2-diphenyl-2-picrylhydrazyl (DPPH) free radical scavenging assay. Mushroom tyrosinase inhibitory activity was performed by UV spectrophotometric procedure using L-3,4-dihydroxyphenylalanine (L-DOPA) as a substrate. Among the selected plants, *Actinidia deliciosa* (pulp) showed the highest DPPH free radical scavenging activity (90.74% in 100 µg/ml concentration) compared to the standard ascorbic acid (96.86% in 100 µg/ml concentration). Similarly, mushroom tyrosinase inhibitory activity was found to be highest in the plant *Solanum tuberosum* (pulp) i.e. 66.66% followed by *Actinidia deliciosa* (pulp and peel) i.e. 52.38% as compared with the standard kojic acid (95.23%). This study concluded that *Actinidia deliciosa* exhibited better antioxidant and mushroom tyrosinase activities. Therefore, the plant *Actinidia deliciosa* may be found useful for the treatment of skin pigmentation and different Reactive Oxygen Species related diseases.

Keywords: DPPH antioxidant activity, Depigmentation, Mushroom tyrosinase inhibitory activity

Iron Biofortification In Microalgal Biomass [PP 18]

Nasla Shakya[1], Alisha Gazmer[1], Keya Sharma[1], Rajani Singh[1], Aayush Kar[2], Sanjaya Lama[3], Nirpesh Dhakal[1,*]

[1]SANN International College, Kathmandu, Nepal

[2]D.Y. Patil University School of Biotechnology and Bioinformatics, Mumbai, India

[3]Research Institute for Bioscience and Biotechnology (RIBB), Kathmandu, Nepal

***Corresponding E-mail:** nirpeshdhakal96@gmail.com

Abstract:

Micronutrient deficiency (MND) is a global challenge that has affected the population in developed as well as developing countries. Micronutrients are essential for optimal physiological function to live the healthy life. Among the MNDs, iron deficiency anemia is the most prevalent one affecting staggering 2 billion people – over 30% of the world's population.

Microalgae being a promising high value nutraceutical, can be a suitable option to combat the iron deficiency anemia. *Chlorella* and *Spirulina* being well-known microalgae genus, both have a significant content of proteins, vitamins, fatty acids and micronutrients. Among the micronutrients, iron was found to occur in significant amounts in both of the algae genus. The bioaccumulation characteristics of the microalgae was exploited and the iron enhanced medium was used to meet the aim of the research.

The iron enhanced Bold basal medium (BBM) was used to bio-fortify the *Chlorella spp*. and iron enhanced Zarrouk's medium was used to bio-fortify the *Spirulina spp*. The specific growth rates of the microalgae were calculated through absorbance and dry weight to detect the effect of iron in the growth of the microalgae. The significant growth in the *Chlorella spp*. was found by adding 15 fold and 20 fold of iron ($FeSO_4.7H_2O$) in Bold Basal Medium (BBM) with the specific growth rate 15X (0.332/h) and 20X (0.333/h) whereas the specific growth rate in the microalgae cultured in standard BBM was found to be C. Std (0.251/h). Similarly, the effect of iron was also detected in the intracellular components such as polysaccharides, lipids, proteins and pigments as well.

Keywords: Bio-fortification, Microalgae, Micronutrient deficiency

Recovery Stress Enhancement In Shape Memory Composites From Cellulose Microparticles-Reinforced Bio-Based Benzoxazine-Epoxy Copolymers [PP 19]

Nattorn Paijit[1,*], Sanong Ekgasit[2], Attasith Parnsubsakul[2] , Sarawut Rimdusit[1]

[1]Chulalongkorn University, Bangkok, 10330, THAILAND/Faculty of Engineering

[2]Chulalongkorn University, Bangkok, 10330, THAILAND/Sensor Research Unit, Department of Chemistry

***Corresponding E-mail:** nattorn_nus@hotmail.com

Abstract:

In this research, cellulose microparticles were employed as renewable reinforcing microfillers for bio-based benzoxazine/epoxy shape memory composites. The bio-based benzoxazine resin was prepared by the Mannich-like condensation of vanillin, furfurylamine, and paraformaldehyde. Cellulose microparticles were prepared through spray drying process of regenerated bacterial celluloses. Chemically cross-linked shape memory polymer networks were formed by curing the bio-based epoxy resin, i.e. epoxidized castor oil, with the bio-based benzoxazine resin. The contents of the cellulose microparticles were varied from 0, 1, 3, and 5 wt%. Dynamic mechanical properties and recovery stress of cellulose microparticles-filled shape memory composites were investigated by a dynamic mechanical analyzer in tensile mode. The results revealed that the storage modulus and recovery stress substantially increased with increasing the cellulose content. These results suggest a potential usage of the cellulose composites for self-deployable shape memory devices.

Keywords: Benzoaxzine-Epoxy Copolymers, Cellulose microparticles

Phytochemical Screening, Antioxidant Activity And Determination For Total Phenol And Flavonoid Content Of Selected Nepalese Medicinal Plants [PP 20]

Prakash Rawal, Sushil Panta*

School of Health and Allied Sciences, Faculty of Health Sciences, Pokhara University Pokhara-30, Kaski, Nepal

***Corresponding E-mail:** sushilmax@hotmail.com

Abstract:

The aim of the present study was to perform phytochemical analysis of selected Nepalese medicinal plants, to screen them for their antioxidant activity and determination of total phenol and flavonoid content. Five medicinal plants namely *Urtica parviflora, Dendrocalamus hamiltonii, Smallanthus sonchifolius, Artocarpus heterophyllu and Fagopyrum megacarpum* were collected for the study based on their traditional medicinal uses and literature review. Ethanolic and aqueous extracts of the dried plants were prepared by double maceration. The phytochemical analysis revealed the presence of flavonoids, alkaloids, tannins, saponins, phenols, terpenoids and carbohydrates in all five plants. The antioxidant activity of the ethanolic and aqueous extract of *F. megacarpum* was determined at different concentrations by DPPH (2, 2-diphenyl-1-picryl-hydrazyl) radical scavenging method using ascorbic acid as the positive control and the IC_{50} values were calculated. The antioxidant activity assay of the ethanolic extract of *F. megacarpum* showed IC_{50} value of 3.65 µg/ml and the aqueous extract showed IC_{50} value of 3.52 µg/ml which was comparable with standard ascorbic acid with IC_{50} value of 3.56 µg/ml. Determination of the total phenolic content was performed according to the Folin-Ciocalteu method using gallic acid as standard and the total flavonoids content was determined by using quercetin as standard. Among all five plants, the aqueous extract of *F. megacarpum* showed higher phenol content i.e. 341.75±1.57 mg gallic acid equivalent (GAE)/g dry weight of extract and flavonoid content i.e. 1153.59±7.05 mg quercetin equivalent (QE)/g dry weight of extract. The ethanolic extract showed 273.44±1.23 mg GAE/g and 1110.5±3.46 QE/g dry weight of extract.

Keywords: Phytochemical screening, Antioxidant activity, Medicinal plants, Phenols, Flavonoids

Fabrication And Characterization Of The Cellulose Microfibers From The Bamboo Fragment [PP 21]

Pruttipong Pantamanatsopa[1,*], Warunee Ariyawiriyanan[2], Sanong Ekgasit[3]

[1]Department of Materials and metallurgical Engineering, Faculty of Engineering, Rajamangala Universityof Technology Thanyaburi, Thanyaburi, Pathumthani 12110, Thailand;

[2]Sensor Research Unit (SRU), Department of Chemistry, Faculty of Science, Chulalongkorn University, Bangkok 10330, Thailand;

[3]Research Network NANOTEC-CU on Advanced Structural and Functional Nanomaterials, Chulalongkorn University, Bangkok, 10330, THAILAND

***Corresponding E-mail:** pruttipong_p@mail.rmutt.ac.th

Abstract:

In recent years, much attention has been given to biodegradable materials with an interest in sustainable development and environmentally friendly. Following this aim, the attempt has been made to replace microfiber derived from plastic with cellulose microfiber (CMF). However raw material for made CMF have many impurities i.e. lignin, hemicellulose, and other residues. This research aims to fabricate and characterize the CMF from bamboo fragment obtained from local Thai furniture industry as raw materials. Bamboo fragment is a waste from furniture production. This research also increase value to bamboo fragments. The CMF were extracted bamboo fragment via alkaline treatment with sodium hydroxide before bleaching with hydrogen peroxide. Scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FTIR) and nuclear magnetic resonance spectroscopy (NMR) were employed for CMF morphology and spectroscopic characterization. The morphological results from SEM images did show the difference between the clean fiber and raw bamboo fiber. The bleached fibers show clean microfiber with diameter of 5-10 µm. The results from the FTIR spectrum did show bleached fibers were free of lignin and hemicellulose. The absorption band at 1725 cm-1 is characteristic of hemicellulose and those at 1602 cm-1 and 1453 cm-1 are characteristic of lignin. Result from NMR spectrum show the same trend with FTIR. Chemical shifts at 151 ppm, 53 ppm were characteristic of lignin while that at 19 ppm was characteristic of hemicellulose.

Keywords: Bamboo, Cellulose Microfibers, FTIR, NMR

Effect of Green Synthesized Iron Nanoparticles On Wheat Germination [PP 22]

Rajina Shrestha[1,2], Manish Baral[1], Bishnu Marasini[2], Mitesh Shrestha[1,*]

[1]Research Institute for Bioscience and Biotechnology, Kathmandu, Nepal

[2]National College, Khusibu, Kathmandu, Nepal

***Corresponding E-mail:** shresthamitesh@gmail.com

Abstract:

A deficiency in the availability of nutrients in plant food sources can result in health altercation and their effects can be severe in populations heavily dependent on plant based diet. Despite being the fourth most abundant element in the lithosphere, and present abundantly in soil, the bioavailability of iron in aerobic and neutral pH soil is challenging. Iron Nanoparticles in low concentrations could be used as fertilizer in soil and also as a foliar spray. This study was aimed to synthesize Iron nanoparticles through a non-toxic, low cost, and environmentally friendly method i.e. from water extracts from wheat seeds of different varieties (WK 1712, WK 1204, and Chyakhura). The synthesized nanoparticles showed characteristic peak at 370 nm under UV-VIS Spectrophotometer. The synthesized nanoparticles were then used for wheat germination experiment. Vitality indices and germination rate were calculated for each of the synthesized nanoparticles. For vitality index, nanoparticles synthesized from WK1204 at 125 ppm ($WK12I_{125}$) and Chyakhura at 125 ppm (ChI_{125}) had similar effect compared to water and 125 ppm concentration of Ferric Chloride. Hence, it can be concluded that our synthesized nanoparticle does not pose toxicity to wheat seeds. Similarly, for germination rate, $WK12I_{125}$ had similar effect to water while had significant improvement over $FeCl_3$ at 125 and 500 ppm. Hence, these preliminary results show that iron nanoparticles might be used as an alternative iron fertilizer.

Keywords: Ferric Chloride, Iron Nanoparticles, Wheat

Determination Of Infection Outbreak Potential Of Hospital And Municipal Wastes [PP 23]

Satya Raj Poudel[2], Upasana Shrestha[1], Prajita Thapa Magar[2], Rojita Tuladhar[1], Bijay Bajracharya[1], Roshan Lal Shrestha[1], Bivek Timalsina[1], Deena Shrestha[1,*]

[1]Center for Health and Disease Studies – Nepal (CHDS), Shankhamul, Kathmandu, Nepal

[2]St. Xavier's College, Maitighar, Kathmandu, Nepal

***Corresponding E-mail:** deenabajra@gmail.com

Abstract:

Wastes are the reservoirs of harmful infectious agents such as the pathogens and multiple drug resistant microorganisms. Hospitals are a place where patients' problems are diagnosed, analyzed and treated. So, Health care waste is delivered from different helpful strategies in healing facilities of the patients. These outcome lead to the creation of non-dangerous waste (75– 95%) and risky waste (10– 25%). Thus, it may possess the threat of nosocomial infection, occupational risk of infection as well as environmental risk as being contaminated with the municipal waste near to the hospital areas. The purpose of the study was to isolate and identify the microorganism from three different hospital wastes and its surrounding municipal wastes and observe the drug resistance pattern and to screen those producing Extended Spectrum β-Lactamases (ESBLs) and Methicillin Resistant *S. aureus* (MRSA)s. During the study period, different specimen as hospital wastes (Gloves, Sharp needles, syringes, Swab) and municipal waste (sewage, fruit peel, wrappers) were collected, transported and processed. An average of 3.8×10^9 cfu/ml viable count of the organism was obtained as the highest load. The isolates were identified by semi quantitative culture technique, conventional biochemical tests, microscopy and subjected to antimicrobial susceptibility testing by Kirby Bauer disc Diffusion method following the CLSI guidelines 2016. *S. aureus* was the most dominant organisms in both the hospital and municipal wastes accounting 52.05% (38/73) and 47.95% (35/73) respectively followed by E.coli being 57.4% (31/54) and 42.59% (23/54) and K. pneumonia 52% (13/25) and 48% (12/25) respectively. Hence, both hospital and municipal wastes showed similar trend of prevalence of bacterial isolates indicating the possibility of cross contamination of bacteria across hospital and corresponding municipal areas. Production of ESBL and MRSA were determined by combined disc assay. The percentage of MDR, ESBL and MRSA accounted as 50.54%, 32.72% and 40% respectively from hospital waste despite of being discarded after disinfection. Colistin and Polymixin B were found to be the most effective drugs against the isolates.

Keywords: Hospital waste, Municipal waste, Multidrug Resistance, ESBL, MRSA

Optimization Of Polyhydroxy Butyrate Production In Bacteria By Response Surface Methodology And Production In Molasses. [PP 24]

Samrat Paudel, Saroj Nepal, Sushil Dhungana, Sangita Shakya*

Department of Biotechnology, Kathmandu University, Dhulikhel, Nepal

***Corresponding E-mail:** sangita@ku.edu.np

Abstract:

Optimization of Polyhydroxy butyrate Production in Bacteria by Response Surface Methodology and Production in Molasses. Samrat Paudel, Saroj Nepal, Sushil Dhungana Department of Biotechnology School of Science Kathmandu University Supervisor: Sangita Shakya, PhD Polyhydroxy butyrate (PHB), a biopolymer and reserve of energy for certain bacteria, is a potential alternative for plastic. It is a thermoplastic which can be co-polymerized into different grades of plastics of varying degradability and strengths. Among the 16 samples taken from ground water of Kathmandu University 8 bacterial cultures showed positive result with Sudan Black B staining. The one with darkest stain was selected and the morphological as well as biochemical characteristics of the selected bacteria was studied. The Hypochlorite-Chloroform extraction procedure was used to extract the PHB from the bacterial cells and the PHB was quantified at 235nm using spectrophotometer, after converting PHB to Crotonic acid by boiling with concentrated sulfuric acid. Design of Experiment (DOE) approach was used to determine the optimum value of different parameters governing the production of PHB, with support of Design Expert Software 11. Among the 10 parameters taken for study the 3 significant factors; Nitrogen, Temperature and Carbon determined from the minimum run screen were taken for Central Composite Design. The Response Surface Methodology gave the optimum values as 4.28 g/l for Carbon, 1.79 g/l for Nitrogen and 32.68oC for Temperature. The mathematical model for the optimum culture condition was obtained. One of the significant finding of the study was the interaction of Carbon and Nitrogen, Nitrogen alone has no effect on the production of bioplastic but exerts combined effect with the Carbon. Under these optimized conditions, the bacteria were grown in molasses; cheap and rich substrate with potential for industrial application, and the maximum yield was determined to be 519.753 µg/mg of dry cell mass.

Keywords: Biopolymer, Design of Experiments (DoE), Molasses, Optimization, Polyhydroxyalkanoates (PHA), Polyhydroxy butyrate (PHB), Response Surface Methodology (RSM)

The Improvement Of Cellulose Nanocrystal Extraction Method

[PP 25]

Warunee Ariyawiriyanan[1,*], Pruttipong Pantamanatsopa[2], Sanong Ekgasit[3]

[1]Department of Materials and metallurgical Engineering, Faculty of Engineering, Rajamangala University of Technology Thanyaburi, Thanyaburi, Pathumthani 12110, Thailand

[2]Sensor Research Unit (SRU), Department of Chemistry, Faculty of Science, Chulalongkorn University, Bangkok 10330, Thailand

[3]Research Network NANOTEC-CU on Advanced Structural and Functional Nanomaterials, Chulalongkorn University, Bangkok, 10330, THAILAND

***Corresponding E-mail:** warunee.a@en.rmutt.ac.th

Abstract:

In recent years, the environmental problem has become a major issue and the demand for bio-materials able to replace materials based on fossil resources has constantly been growing. From this trend, cellulose, the most abundant organic compound on earth, with the advantage of a low density, low cost, and biodegradability is the most appropriate material. Bamboo is one of the cellulose sources. Bamboo fiber can be transformed into cellulose nanocrystal (CNC). There are same problems with purification after sulfuric acid hydrolysis due to the usage of high acid to fiber ratio (sulfuric acid and cellulose microfibers (CMF) of 10:1). This study is aimed to improve the production process. The CMF from bamboo fragment was prepared by cleaning the bamboo fragment with NaOH solution and bleaching using alkaline hydrogen peroxide. To prepare cellulose nanocrystal (CNC) suspensions, bleached bamboo was hydrolyzed by an addition of 50%v/v sulfuric solution. For bamboo, the acid hydrolysis was performed by varying different weight of bamboo bleached of 1, 2, and 3 g with 10 mL acid solution. The ratio of 3:10 give the highest yield of CNC. The CNC suspensions display clear and bright flow birefringence under a cross-polarized light.

Keywords: Cellulose Microfibers, Cellulose Nanocrystal

In-Vitro Screening Of *Trichoderma Spp.* Against Phytopathogen *Fusarium Solani* [PP 26]

Nawanit Kumar Mahato, Prajwal Rajbhandari*

Research Institute for Bioscience and Biotechnology, Kathmandu, Nepal

***Corresponding E-mail**: prajjwalrajbhandari@ribb.org.np

Abstract:

Tomato (*Lycopersicon esculentum L.*) is one of the economically important vegetable crops that is frequently attacked by *Fusarium solani* which principally cause foot rot and root rot. *Trichoderma spp*., a known beneficial fungus, has been reported to enhance plant growth and also control disease. For this study, 25 soil samples were collected from organic fields around Kathmandu valley and Chitwan, Nepal. Soil samples were serially diluted and plated on Potato Dextrose Agar at 28ºC for 7 days. Morphological identification of *Trichoderma spp*. was done under microscope with lacto phenol cotton blue staining method. In-vitro biocontrol efficacy of *Trichoderma spp.* was tested against the fungal pathogen *F. solani* by dual culture technique and was found to inhibit growth by 40%. Hence, the isolated *Trichoderma spp*. could be an alternative biocontrol agent.

Keywords: Organic, Biocontrol agent, Dual culture technique

Guava Leaves As Natural Preservatives For Small-scale Farmers Of Nepal [PP 27]

Rukusha Maharjan, Rita Majhi, Rojlina Manandhar, Angisha Basnet, Aatish Mali, Mitesh Shrestha, Prajwal Rajbhandari*

Research Institute for Bioscience and Biotechnology, Kathmandu, Nepal

***Corresponding E-mail:** prajjwalrajbhandari@ribb.org.np

Abstract:

Food losses have become a major issue worldwide. Approximately 1.3 billion tonnes of food are lost or wasted every year due to microorganisms, physical damage and oxidation of foods. As such, farmers of developing countries like Nepal, who also suffer from food losses of up to 45 % during post harvest face substantial economic burden. To overcome this problem, guava leaves, which has been known to posses antioxidant and antibacterial properties, would be suitable for local communities of Nepal to be used as natural preservatives. Initially, food spoilage microrganisms were isolated from 7 different fruits and vegetables collected from Balkhu, Kalimati and Dhulikhel area, and identified through biochemical and molecular characterization. A total of 39 bacteria and 17 fungi were isolated, of which, the 16s rRNA and 18s rRNA regions of 34 bacteria and 10 fungi were partially sequenced and deposited at National Centre for Biotechnology Information (NCBI) database. Secondly, guava leaves were collected, washed and shade dried then crude extracts were prepared using different extraction protocols (2 days room temperature, 25°C, 35°C, 80°C and 100°C). Antibacterial activity, phytochemical screening like total phenolics content, total flavonoid content, antioxidant test and banana preservation efficacy under room conditions for all of the extracts were done. Among these, the extracts obtained from 2 days RT protocol showed promising results against isolated food spoilage bacteria. Higher amounts of phytochemical and banana preservation study indicated the extract obtained from 2 days RT extraction protocol to be better. Hence, it can be concluded that guava leaves could be a viable option for preparation of natural preservatives.

Keywords: Food loss, Guava leaves, Natural preservatives, Postharvest

Formation of Cationic Fmoc-Phe Based Hydrogels For Display of Antibacterial Activity [PP 28]

Sunita Pandey[1,2], Annada Rajbhandari[1,*]

[1]Research Institute for Bioscience and Biotechnology, Kathmandu, Nepal

[2]Department of Biotechnology, Kathmandu University, Kavre, Nepal

***Corresponding E-mail:** annada_raj@hotmail.com

Abstract:

Self-assembling peptide hydrogels are biocompatible scaffolds that have been used in a number of tissue engineering applications, such as bone and cartilage reconstruction, heart tissue regeneration, angiogenesis, and more. C-terminally modified Fmoc-Phe, unlike other self-assembling peptides, are able to self-assemble in aqueous solution mediated by attractive and directional π-π interactions involving the Fmoc-protecting group and the aromatic amino acid side chains. These low molecular weight (LMW) hydrogels are superior to polymer based hydrogels because they are biodegradable, non-immunogenic and non-toxic as they bear resemblance to the natural extracellular matrix (ECM), for in vivo cell support.

It has been shown that peptide-based cationic hydrogels have antibacterial properties due to disruptive interactions of the cationic fibrils with the anionic cell walls of the bacteria. Furthermore, such hydrogels allow cell proliferation. Our results have shown that cationic Fmoc-Phe hydrogels also demonstrate similar antibacterial properties against *Staphylococcus aureus and Escherichia coli*. Such Low Molecular Weight hydrogelators can be a simple, cheaper and easy alternative to peptide based hydrogels with similar antibacterial properties, while also allowing mammalian cell viability.

Keywords: Antibacterial, Cationic hydrogel, cell proliferation, C-terminally modified Fmoc-Phe, Fibrillization, Low molecular weight (LMW) hydrogelators, Self-assembly

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