

Report on
**Sustainable
Development**

GOAL 3



**GOOD HEALTH AND
WELL-BEING**

Ensuring healthy lives and promoting well-being at all ages is essential to sustainable development.



Sustainable Development Goal 3 aims to achieve universal health coverage while ensuring healthy lives and promoting well-being at all ages. With 13 Targets and 28 Indicators for SDG 3, the universities have a significant role in addressing specific health conditions and promoting well-being for prosperous societies.

At Shiv Nadar, we have invested into addressing various indicators of SDG-3 through teaching, research, institutional practices and partnerships.

1 Teaching and Learning

The University offers many undergraduate courses at the Department of Life Sciences, such as Immunology (BIO 207) and Biology of Infectious diseases (BIO 306), which delivers on the history of infectious diseases, concepts of disease dynamics, parasite diversity, evolution & ecology of infectious diseases besides emergence of diseases. Recombinant DNA technology (BIO 307), Drug design &

drug development (BIO 308), Cancer Biology (BIO 309), Host-pathogen interaction (BIO 314), Epigenetics (BIO 323), Neuroscience and Cognition (BIO 332) to name a few. The Department of Chemistry offers a course in Informatics and Drug discovery (CHY 522), which explores the field of Bioinformatics and Cheminformatics to find new drugs with specific physiological effects.

Ph.D. research scholar work

1. Drug Repurposing

Shalini Yadav, a research scholar at the Department of Chemistry, School of Natural Sciences (SNS), works on drug repurposing. This is significant research in view of COVID-19, which emerged as a devastating pandemic. The drug repurposing process allows researchers to find different indications of FDA-approved or investigational drugs. In this study, a sequence of pharmacophore and molecular modeling-based screening against COVID-19 Mpro (PDB: 6LU7) suggested a subset of drugs, from the DrugBank database, which may have antiviral activity.

The results of this computer-aided drug design provides a roadmap for rational drug design of Mpro inhibitors and the discovery of certified medications as COVID-19 antiviral therapeutics. This paper has been cited 22 times in just one year.

Souvik Banerjee, Shalini Yadav, Sourav Banerjee, Sayo O. Fakayode, Jyothi Pavathareddy, Walter Reichard, Ryan Whatcott, Joshua Thammathong, Bernd Meibohm, Duane D. Miller*, Col- leen B. Jonsson*, Kshatresh Dutta Dubey*.

Drug Repurposing to Identify Nilotinib as Potential SARS-CoV-2 Main Protease Inhibitors: An Insight from Computational and In Vitro Study. *J Chem Inf and Model*, 61, 5469-5483, 2021.

2. Unraveling key interactions and the mechanism of demethylation during hAGT-mediated DNA repair via simulations

Dr. Kshatresh Dubey, Assistant Professor, Department of Chemistry, and a team of research scholars, Shruti TG and Shakir Ali Siddiqui, are undertaking extensive research

on DNA repair mechanisms. Their team is studying alkylating agents, which pose the biggest threat to the genomic integrity of cells by damaging DNA bases through regular alkylation. Several automated machinery inside the cell repair such damages. The current research uses extensive MD simulations and hybrid QM/MM calculations, to investigate key interactions between the DNA lesion and the hAGT enzyme and elucidate the mechanisms of the demethylation of the guanine base.

TG, Shruti, Shakir Ali Siddiqui, and Kshatresh Dutta Dubey.

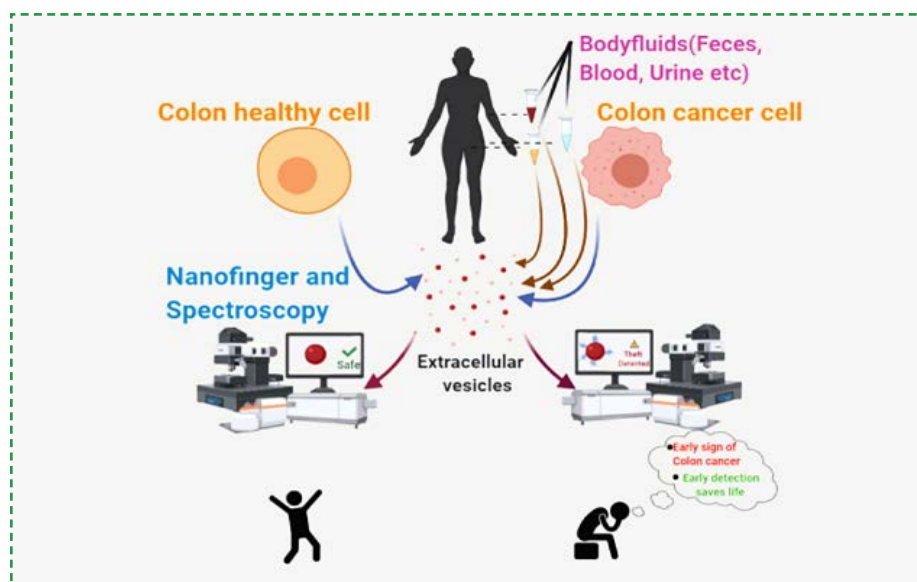
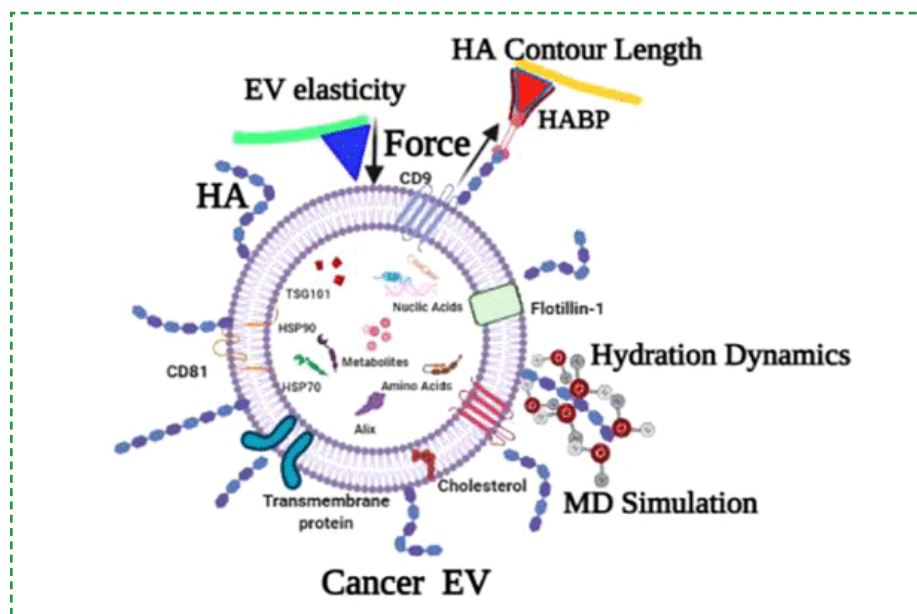
“Unraveling key interactions and the mechanism of demethylation during hAGT-mediated DNA repair via simulations.” *Frontiers in Molecular Biosciences* 9 (2022): 975046.

2 Research

At Shiv Nadar, many faculty and researchers are working on path-breaking research on drug design, bioinformatics, and disease dynamics. Here we highlight some exciting research projects by the faculty.

1. A mechanoelastic glimpse on hyaluronan-coated extracellular vesicles

Tatini Rakshit, Assistant Professor, Department of Chemistry and her team of researchers have unveiled a game-changing discovery in colon cancer research. They have identified a biomarker, hyaluronan, a sugar molecule on colon cancer extracellular vesicles. These tiny vesicles derived from cancer cells are covered with unique short-chain hyaluronan polymers, setting them apart from normal vesicles. These cancer extracellular vesicles exhibit remarkable intrinsic flexibility, giving rise to a potential cancer biosensor.



A mechanoelastic glimpse on hyaluronan-coated extracellular vesicles¹

Using state-of-the-art high-resolution atomic force microscopy (AFM) and spectroscopy (AFS) techniques, the researchers delved deep into the differences between colon cancer cell-derived vesicles and those from normal colon epithelial cells, all at the single-vesicle level. The finding marks a pivotal step toward detecting hyaluronan-coated extracellular vesicles as a potential colon cancer biomarker. This groundbreaking study opens exciting possibilities for early-stage colon cancer detection and evaluation.

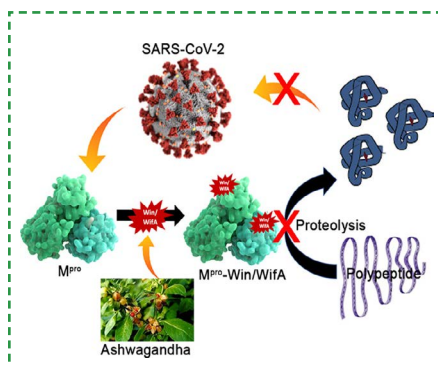
Paul, Debashish, Anirban Paul, Dipanjan Mukherjee, Saroj Saroj,

Manorama Ghosal, Suchetan Pal, Dulal Senapati, Jaydeb Chakrabarti, Samir Kumar Pal, and Tatini Rakshit. “A Mechanoelastic Glimpse on Hyaluronan-Coated Extracellular Vesicles.” *The Journal of Physical Chemistry Letters* 13, no. 36 (2022): 8564-8572.

2. Effective and less toxic therapeutic strategies for cancer patients

Dr. Anindita Chakrabarty, Associate Professor at the Department of Life Sciences, works on mode of action of various experimental and approved anti-cancer drugs and natural

¹<https://pubs.acs.org/doi/10.1021/acs.jpcllett.2c01629>



products - to devise effective and less toxic therapeutic strategies for cancer patients.

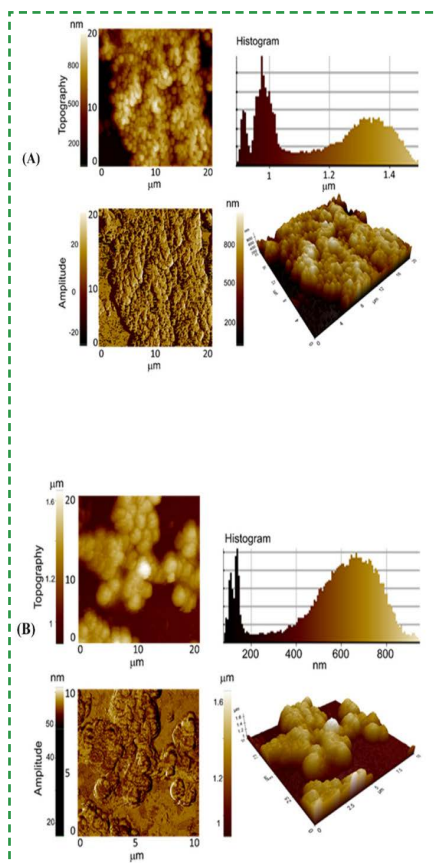
A unique feature of this research is to tackle the problem of anti-cancer drug resistance in real-time, which will help prevent it early and save patients from unwanted toxicity and disease recurrence. By collaborating with electrical engineers, they are developing a technique for controlling unresectable cancers through high-voltage nanosecond electric pulses, also marketed as nanoknife in the USA. Dr. Chakraborty's team is also working to explore the possibilities of repurposing a few synthetic and naturally-occurring anti-cancer agents as SARS-CoV-2 antivirals that may be significant in the use of non-toxic alternatives to the currently available antiviral paxlovid, marketed by Pfizer.

Shyantani Chakraborty, Dibyendu Mallick, Mausumi Goswami, F. Peter Guengerich, Anindita Chakraborty, and Goutam Chowdhury. The Natural Products Withaferin A and Withanone From the Medicinal Herb *Withania somnifera* are Covalent Inhibitors of the SARS-CoV-2 Main Protease. *ACS J Nat. Prod.* 2022, 85(10), 2340-2350

3. Nanoparticles as potential solution to antibiotic resistance

Dr. Bimlesh Lochab, Professor, Department of Chemistry and Dr. Richa Priyadarshini, Associate Professor, Department of Life Sciences in collaboration with other researchers have synthesized three reduced

²<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8782023/>



Representative AFM (topography, histogram, 3D, and amplitude) images of *S. aureus* after incubation with the 200 µg/mL rGO-S/Se NPs. *S. aureus* in the absence of NPs was taken as the positive control. (A,B) *S. aureus* after 8 h incubation with rGO-S/Se NPs, Scale bar = 10 µm.²

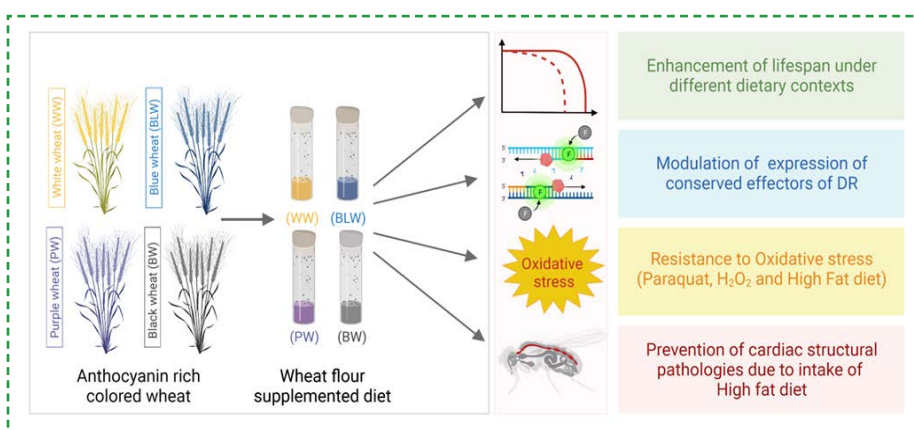
graphene oxide (rGO) nanoparticles, namely rGO, rGO-S, and rGO-S/Se, and characterized them using X-ray diffraction (PXRD), Raman analysis, and Thermogravimetric analysis. They argue that resistance to antimicrobial agents in Gram-positive bacteria is one of the major concern in the last decade. Recently, nanoparticles (NP) have emerged as a potential solution to antibiotic resistance. Antibacterial properties of all three

nanomaterials were probed, and the studies have revealed that rGO composite nanoparticles deposit on the bacterial cell surface, resulting in membrane perturbation and oxidative stress. Thus, suggesting a possible three-pronged approach to bacterial cytotoxicity by these graphene-based materials.

Niranjan, Rashmi, Saad Zafar, Bimlesh Lochab, and Richa Priyadarshini. "Synthesis and characterization of sulfur and sulfur-selenium nanoparticles loaded on reduced graphene oxide and their antibacterial activity against gram-positive pathogens." *Nanomaterials* 12, no. 2 (2022): 191.

4. Dietary interventions in promoting health during aging

Dr. Geetnali Chawla, Associate Professor, Department of Life Sciences has undertaken a study on dietary intervention during aging. Clinical studies with single antioxidant supplements such as beta carotene and vitamins (A, C, and E) have demonstrated that single antioxidants do not protect against chronic diseases including heart disease and cancer. There is substantial evidence to suggest that the intake of antioxidant-rich fruits, vegetables, and whole grains consumed in their natural context is associated with a lower risk for chronic oxidative stress-related diseases like cardiovascular diseases. This study showed that plant-based diets formulated with biofortified cereal crops promotes healthy aging and delays the



progression of diseases that are exacerbated by the accumulation of oxidative damage.

Manish Pandey, Sakshi Bansal and Geetanjali Chawla. Evaluation of lifespan promoting effects of biofortified wheat in *Drosophila melanogaster*, *Experimental Gerontology* (2022), <https://doi.org/10.1016/j.exger.2022.111697>.

3 University Operations

At Shiv Nadar, we believe that health and well-being are absolutely essential to academic, professional, and personal success.

We have put in place many essential health and support services. Deliver regular workshops to train students and staff. And provide necessary education and training to our contractual support staff.

Health and Wellness

The University has a health center with residential para-medical staff and visiting doctors. It provides physical and mental health support through a primary health care setup and an OPD. The center has general and emergency wards with necessary equipments, managed by professionally qualified and well-trained paramedic staff, 24x7 nursing

staff & an ambulance. All members of the University can avail these services and book appointments through a well-defined process. In addition, we have a committed team of doctors (general physicians), counselors, dentists, physiotherapists, and visiting psychiatrists to provide a safe, welcoming, and affirming environment for all students while supporting and enhancing all students' psychosocial well-being and development.

Medical insurance

All students and staff are eligible to avail medical insurance policy covering medical issues requiring hospitalization beyond the on-campus services.

Indoor Sports Complex (ISC)

Shiv Nadar has a uniquely designed, state-of-the-art Indoor Sports Complex (ISC). ISC has a fully equipped unisex fitness center (Gym) with high-end cardio machines, weight stations, strengthening equipment, and a 200-meter-long indoor running track. Regular yoga and meditation sessions are organized at the meditation and yoga hall. The University offers other indoor and outdoor sports facilities: horse riding, golf, cricket, basketball, badminton, tennis, football, billiards, etc.



Zero tolerance policy

At Shiv Nadar, we observe zero tolerance for Procuring and/or Possessing and/or Consumption and/or Aiding and/or Selling of any narcotic drug or psychotropic substances and have set of rules and policies.

Health advisories and blood donation camp

The University organizes advisories on wellness and preventive measures, peer support groups, online awareness programs, and global mental wellness series. Regular blood donation camps are organized that allow many students, staff & faculties to donate blood.

Metanoia, a student club

Metanoia is a mental health awareness and wellness club that aims to create a safe space to discuss mental and physical health issues. The club invites experts and organizes many engaging seminars, workshops, and activities on themes such as mental health and emotional well-being, managing stress and building resilience, strategies for enhancing emotional Intelligence, and suicide prevention. The medical personnel on campus supervise the club activities.

Student support system

The Office of the Dean of Students (ODS) selects *Family Groups* to support first-year undergraduate students. A family head is selected from the senior classes, to aid in seamless and friendly transition during the initial settling phases of first year students. These groups, help students get support, guidance and facilitates them to access necessary information.

Other Initiatives

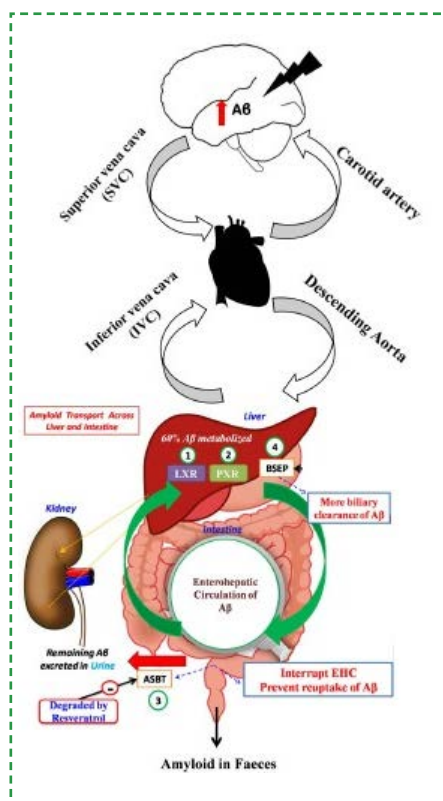
Training contractual support staff on sexual health and clean sanitation

Regular workshops are conducted to train and educate our contractual support staff on sexual health and clean sanitation. Restrooms are provided with sanitary pads and safe disposal machines.

4 Partnerships

1. RNA Biology Laboratory at the Department of Life Sciences, the School of Natural Sciences.

The DBT-Wellcome Trust India Alliance and Shiv Nadar IoE have funded the RNA Biology laboratory to uncover post-transcriptional mechanisms in aging and dietary restriction. The research in the laboratory is focused on testing the efficacy of diet and RNA-based therapeutic strategies to fine-tune conserved metabolic pathways that can, in addition to providing a broad-spectrum health improvement can, also be utilized for the cost-effective treatment of multiple age-related diseases simultaneously. Dr. Geetanjali Chawla, Associate Professor, Department of Life Sciences, leads the research to evaluate the role of dietary and RNA-based interventions in promoting health during aging and age-related diseases.



Therapeutic approach to Alzheimer's patients by enhancing elimination of brain's toxic amyloid through kidney and liver using cilostazol as drug.

2. Indo-French collaboration working on the molecule to slay Covid

Dr. Subrabrata Sen, Professor, Department of Chemistry, along with his team of researchers have discovered a new general class of antivirals against severe acute respiratory syndromes caused by SARS CoV and similar viruses. This research was jointly conducted with Prof. Ralf Jockers from Institut Cochin, Paris. Dr. Sen was invited to work as a visiting scientist at the Dr. Ralf Jocker's lab, Institut Cochin, Paris, France, to research novel COVID-19 drugs.

In this breakthrough research, a novel molecule has shown promise in lab tests as a potential preventive against variants of the SARS-CoV-2 virus and can potentially treat the acute and long-term symptoms of COVID-19. The team has published articles and applied for patents.

3. Novel therapeutic and diagnostic approach in neuroscience & mental health

Dr. Prasun Kumar Roy, Distinguished Professor, School of Natural Sciences, is pioneering research in therapeutic or diagnostic development for the neural system. He has three collaborating institutions: Institute of Medical Sciences (IMS, BHU), Varanasi, Indian Space Research Organization (ISRO), Bangalore, and the Indian Institute of Technology (BHU), Varanasi. He, along with his team, has developed a systems biology analysis of the process of permanent remission of the neuroblastoma and melanoblastoma tumors due to the patient's own anti-cancer immunity and identified the genes responsible, and the drugs which can replicate the remission process in other patients. In the cognitive disorder and mental health area, the team works on perceptual judgment errors in schizophrenic and manic-depressive patients. Using brain MRI scanning, the researchers localized the brain networks involved and enabled the identification of perceptual disorders in these patients (DOI: 10.1080/07391102.2022.2154842). Regarding neurodegenerative disease, the investigators have revealed the physiological pathways by which the brain's toxic protein amyloid is efficiently eliminated by the liver or kidney, thus developing a novel therapeutic approach to Alzheimer's disease and dementia, substantiated by indicative clinical trials analysis (DOI: 10.1080/07391102.2022.2154842). **A. Bhattacharjee, P.K. Roy. Conjoint hepatobiliary-enterohepatic cycles for amyloid excretion and enhancing its drug-induced clearance: A systems biology approach to Alzheimer's disease.** *Journal of Biomolecular Structure and Dynamics.* 12, 1-18 (2022). DOI: 10.1080/07391102.2022.2154842



4. Online counselling and emotional wellness services

Shiv Nadar IoE has collaborated with India's largest Online Counselling portal - YourDost online counselling & emotional wellness services. There are 800+ counsellors on the platform offering counselling in regional languages. This is a free-of-cost service for the entire Shiv Nadar IoE students, who can use the portal online and make an appointment with counselors for an online chat-based/ audio or video session.

5. Department of Design collaborates with AADI

Prakash Kumar, Associate Professor, Department of Design, is working in collaboration with Action for Ability Development and Inclusion (AADI) to propose design solutions to enable a user who uses a wheelchair to board and deboard a car with the least amount of effort. The project undertakes specific interventions to address issues of accessibility faced by a girl with Cerebral Palsy (CP) and her single mother. The new intervention considers ergonomics, cost efficiency, ease of use, and the motor transport rules laid by the regional transport authorities. The new design can easily be fitted and detached in any car.

6. Public access to University sports facilities

At Shiv Nadar, we provide our sports facilities to train students from schools and host tournaments and championships. The fourth edition of 'Sports for Change' (SFC), state and zonal championship was held on June 21-23, 2022 in collaboration with HCL Foundation. Students from across 13 States and 47 Districts of India participated. Besides, we organize table tennis camps to train students from VidyaGyan School, Bulandshahar.

Shiv Nadar Institution of Eminence is fully committed to the UN Sustainable Development Goals (SDGs). We have embraced a four-pronged strategy for SDGs through **teaching, research, our core institutional practices, and partnerships.**

SHIV NADAR

INSTITUTION OF EMINENCE DEEMED TO BE
UNIVERSITY
DELHI NCR

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