Current Position	Post Ph.D. Position
HOD(2020-continue) & Assistant Professor (2012-contine) Department of Biotechnology University of North Bengal, Raja Rammohanpur, Dist.-Darjeeling-734013 West Bengal India Email-anoop@nbu.ac.in anoopnbu@gmail.com Contact No. +91-8768525564 +91-8617889808	Senior Demonstrator Experimental Medicine and Biotechnology (EMB) Post Graduation Institute of Medical Education and Research (PGIMER) Chandigarh-160012 India

Subject Specialization and Research:- Cell and Molecular Biology

Our laboratory **ANMOL** (**Advanced Nanoscale Molecular Oncology Laboratory**) is looking to find anticancer drugs resistance due to autophagy and combinatorial effect of autophagy inhibitors and anticancer drugs effects on normal and cancer cells. The University of North Bengal is surrounded by rich source of medicinal plants and have huge diversity. So, we are also involved in identification of chemical from natural products which can enhance anticancer activity of the drugs.

Google Scholar:- 29.01.2022
https://scholar.google.com/citations?hl=en&authuser=1&user=pYQWj6IAAAAJ
Citation:-409 h-index:-12 i10-index:-13

Patnet:- 1 (Published, 23.03.2019) **Application No.-**201931011330A
Title:-Biogenic Ag nanoparticulate system involving *Morux indica L.* VI leaf extract and its method of manufacture.

Educational Qualification:-

Highest Degree	University	Subject	Year
Ph.D.	Jawaharlal Nehru University, New Delhi, India	Biotechnology	2009
Thesis Title-*" Triplex forming potential of polymorphic PNR sequences in the upstream region of apo(a) gene and identification of PNR binding proteins"*			
M.Sc. (Biotechnology)	Allahabad University, Allahabad (U.P.), India	Biotechnology	2002
B.Sc. (Biology)	Ch. Charan Singh University, Meerut	Chemistry, Botany Zoology	1999
Academic activities/achievements/courses for improvements...			
PGCPP	Indira Gandhi National Open University, India	Patent Practice	2013
CIT	Indira Gandhi National Open University, India	Information Technology	2012
PGDIPR	Indira Gandhi National Open University, India	Intellectual Property Rights	2011

PGCPP:-Post Graduate Certificate in Patent Practice
CIT:- Certificate in Information Technology
PGDIPER:- Post Graduate Diploma in Intellectual Property Rights

International Award

- Recipient of Nature Travel Grant Award for Gordon Research Conferences, 2011(not avail)

National Awards/ Fellowships

S. No.	Name of the Award/ Fellowships	Awarding Agency	Year
1.	DBT studentship fellowship for M.Sc.(Biotechnology)	**Department of Biotechnology, New Delhi, INDIA**	1999-2002
2.	**National Eligibility Test (LS)**	**University Grant Commission, New Delhi, INDIA.**	July, 2001
3.	**National Eligibility Test (JRF)**	**University Grant Commission, New Delhi, INDIA.**	June 2002
4.	**National Eligibility Test (LS)**	**University Grant Commission, New Delhi, INDIA.**	June, 2003
5.	**National Eligibility Test (LS)**	**Indian Council of Agriculture Research, Pusa Road, New Delhi, INDIA**	2003

Number of published papers in five years:- **15**

List of journal(s) with no. of publication	Year of Publication	Impact factor
Journal of Molecular Liquids (1)	2022	6.1
Scientific Report (1)	2019	4.3
Journal of Drug Delivery Science and Technology (1)	2021	3.9
Chemical Physics Letters (1)	2021	2.3
South African Journal of Botany (1)	2021	2.3
RSC Advances (1)	2020	3.108
Chemico-Biological Interactions (1)	2017	3.7
Chemistry Select (2)	2020/2018	1.8
Colloids and Surfaces (1)	2018	3.9
BMC Complementary Medicine and Therapies (2)	2019/2017	2.8
PLOS ONE (1)	2018	3.54
Journal of Molecular Structure (1)	2017	2.4
Colloids and Surfaces B: Biointerfaces (1)	2019	4.3

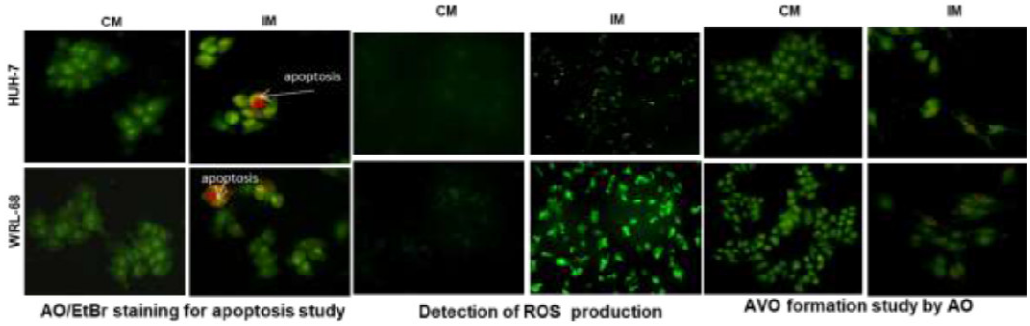
Running Projects: -2021-2024

Title:-"Identification, isolation and bio-evaluation of natural bio-active anticancer compound from leaves of *Masea macrophyla* plant of Darjeeling district"

Funding Agency:- Indian Council of Medical Research (I.C.M.R.), New Delhi, Government of India

Advanced Nanpscale Molecular Oncology Laboraltory (ANMOL)

I take this opportunity to introduce myself to you as cellular and molecular biologist. My laboratory is working on autophagy on cell lines like HepG2, HeLa, KB, SH-SY-5Y, MCF-7, WRL-68, HEK293, NIH 3T3, etc. Currently, I am working on to develop a therapeutic tool to cure drug resistant cancer cells. Induction of autophagy in drug resistance cancer cells to become resistant against drugs are common in drug resistant cancer cells. If we keep cells for longer time without adding nutrients, autophagy gets induced. Because starvation is a good catabolic degradation mechanism to keep cells alive in nutrition deprive condition. I am looking for the role of starvation-induced autophagy, in cell growth of cancer cells and normal cells. I work on normal and cancer cell lines and induced autophagy by starvation. I have found that lysosome plays an important role in induction of autophagy in normal by starvation and differ from cancer cells and pathway is also different. I have confirmed these differences by autophagy related genes biomarkers like Beclin 1, LC3I/LC3II, Atg5, Atg12, Atg 16, Atg3 etc.



Dysregulation of autophagy has been implicated in cancer infection, aging, and neuro degenerative diseases. Glyceraldehyde 3-phosphate dehydrogenase (GAPDH), a glycolytic enzyme, is a central regulator of autophagy with Sirt 1. A new role of GAPDH and APP protein have been identified in autophagic induced human cells. It was observed that the expression level of GAPDH increased in response to starvation in both the control and experimental cells. This may be due to the reason that GAPDH besides being involved in glucose metabolism to provide energy, also acts as a regulator of autophagy by preventing cell death. To rule out the possibility that oxidative signal associated with nutrient deprivation is leading to apoptosis. Apoptosis was evaluated by DNA fragmentation study and Annexin V-FITC. We observed ROS by Dihydroethidium (DHE) assay and by H2DCFDA, Nitric Oxide assay, and GST assay. The expression level of autophagic genes (Beclin-1, LC3A/B, Atg5, Atg12, Atg16L1, Atg7, LC3B, Atg3), APP, BACE 1, p53, beta-actin, and GAPDH were detected by ELISA. GAPDH-APP interaction was studied by sandwich ELISA. We have got interesting results which helped us to understand the metabolic pathway; which switch ON at the starvation stage and have a major role in lysosomal function. Taken all together, our study enlightens that starvation and nutrient deficiency-induced autophagic survival and switch to 'autophagic' apoptosis or necrosis in response to intense stress on lysosome.

I want to continue this work with some advanced technology. We do work on both normal cell line (HEK-293, WRL-68) and Cancer cell line (ACHN, HUH-7). As you can see in above figures where we compare apoptosis, ROS production and AVO formation in both cell lines. Because responses are little bit different for cancer and normal cells. There are few differences at molecular level too.

I have developed autophagy determination protocol through lysosome response by neutral red uptake assay. We are preparing manuscript to for publication in nature exchange protocol.

Publications of 5 years

1. Modhusudan Mondal , Shatarupa Basak, Debadrita Roy, Subhadeep Saha , Biswajit Ghosh , Salim Ali, Narendra Nath Ghosh, Ankita Dutta , **Anoop Kumar** , Mahendra Nath Roy, (2022) Cyclic oligosaccharides as controlled release complexes with food additives (TZ) for reducing hazardous effects, Journal of Molecular Liquids 348 ,118429
2. Swarnendra Banerjee, PallabKar, Indrani Sarkar, AbhijitChhetri, Dipu KumarMishra, AnkitaDutta, **AnoopKumar,**BiswajitSinha, ArnabSen, **(2021),** Structural elucidation and chemical characterization of underutilized fruit silverberry (*Elaeagnus pyriformis*) silver nanoparticles playing a dual role as anti-cancer agent by promoting apoptosis and inhibiting ABC transporters,South African Journal of Botany,https://doi.org/10.1016/j.sajb.2021.06.029
3. A Saxena, A Dutta, N Kapoor, **A Kumar**, A Tiwari, **(2021)** Envisaging marine diatom Thalassiosira weissflogii as a smart drug delivery system for insoluble drugs, Journal of Drug Delivery Science and Technology, 102983
4. Shatarupa Basak , Salim Ali , Modhusudan Mondal , Debadrita Roy , Ankita Dutta , **Anoop Kumar** , Suranjan Sikdar , Mahendra Nath Roy **(2021**) Green synthesis and characterization of heterostructure MnO-FeO nanocomposites to study the effect on oxidase enzyme mimicking, HSA binding interaction and cytotoxicity, Chemical Physics Letters 785 , 139163
5. Sudip Some, Biraj Sarkar,Kinkar Biswas, Tushar K. Jana, Debjoy Bhattacharjya, Paulami Dam, Rittick Mondal, **Anoop Kumar**, Apurba K. Deb, Abdul Sadat, Soumen Saha, Ahmet Kati, Ismail Ocsoy, Octavio L. Franco, Amitava Mandal, Sukhendu Mandal, Amit Kumar Mandal and ˙Ikbal Agah ˙Ince (**2020**) Bio-molecule functionalized rapid one-pot green synthesis of silver nanoparticles and their efficacy toward the multidrug resistant (MDR) gut bacteria of silkworms (Bombyx mori), RSC Adv., 10, 22742
6. S. Dutta, Tushar K. Jana,Suman K. Halder, Ramaprasad Maiti, Ankita Dutta, **A. Kumar**, and K.Chatterjee, (**2020**) Zn2Al-CO3 Layered Double Hydroxide: Adsorption, Cytotoxicity and Antibacterial Performances, ChemistrySelect, 5, 6162 – 6171
7. Sudip Some, Onur Bulut, Kinkar Biswas, **Anoop Kumar,** Anupam Roy, Ipsita Kumar Sen,Amitava Mandal, Octavio L. Franco, İkbal Agah İnce,Kartik Neog, Sandip Das, Sayantan Pradhan, Subhadeep Dutta, Debjoy Bhattacharjya, Soumen Saha, Pradeep K. Das Mohapatra, Anil Bhuimali, B. G. Unni, Ahmet Kati,Amit Kumar Mandal, M. Deniz Yilmaz & Ismail Ocsoy (2019) Effect of feed supplementation with biosynthesized silver nanoparticles using leaf extract of *Morus indica* L. V1 on *Bombyx mori* L. (Lepidoptera: Bombycidae), **Scientific Reports,** https://doi.org/10.1038/s41598-019-50906-6
8. Vijeta Rai, **Anoop Kumar,** Vaskar Das and Shilpi Ghosh, (**2019**) Evaluation of chemical constituents and in vitro antimicrobial, antioxidant and cytotoxicity potential of rhizome of Astilbe rivularis (Bodho-okhati), an indigenous medicinal plant from Eastern Himalayan region of India, BMC Complementary and Alternative Medicine, 19:200
9. Tushar K. Jana, Swapan K. Jana, **Anoop Kumar**, Kalyanashis De, Ramaprasad Maiti, Amit Kumar Mandalf, Tanaya Chatterjeeb,□, Barun K. Chatterjeeg, Pinak Chakrabartib, Kuntal Chatterjee, (**2019**) The antibacterial and anticancer properties of

zinc oxide coated iron oxide nanotextured composites, Colloids and Surfaces B: Biointerfaces 177, 512–519

10. Parbati Basu, Kalyanashis De, Soma Das, Amit K. Mandal, **Anoop Kumar**, Tushar K. Jana, and Kuntal Chatterjee, (**2018**) Silica-Coated Metal Oxide Nanoparticles: Magnetic and Cytotoxicity Studies, ChemistrySelect 3, 7346 – 7353
11. Somit Dutta, Arnab Kumar Chakraborty, Priyankar Dey, Pallab Kar, Pokhraj Guha1,Subhajit Sen, **Anoop Kumar**, Arnab Sen, Tapas Kumar Chaudhuri1, (**2018**) Amelioration of CCl4 induced liver injury in swiss albino mice by antioxidant rich leaf extract of *Croton bonplandianus* Baill, PLoS ONE 13(4): e0196411.
12. Pritam Guha, Biplab Roy, Prasant Nahak, Gourab Karmakar, Chien H. Chang, Alexey G. Bikov, Alexander B. Akentiev, Boris A. Noskov, Amit K. Mandal, **Anoop Kumar**, P.A. Hassan, V.K. Aswal, Takeshi Misono, Kanjiro Torigoe, Amiya K. Panda, (**2018**) Exploring the dual impact of hydrocarbon chainlength and the role of piroxicam a conventional NSAID on soylecithin/ion pair amphiphiles mediated hybrid vesicles for brain – tumor targeted drug delivery, Colloids and Surfaces A, 334-345
13. Shilpi Ghosh, Swagata Mukhopadhyay,Mrinmoy Sarkar,Amitava Mandal, Vaskar Das, **Anoop Kumar,** Biplab Giri (2017) Biological evaluation of a halogenated triterpenoid, 2α-bromo-dihydrobelulonic acid as inhibitor of human topoisomerase IIα and HeLa cell proliferation, Chemico-Biological Interactions,68–76
14. Anukul Maji, Maidul Beg, Amit Kumar Mandal , Somnath Das, Pradeep K. Jha, **Anoop Kumar,** Shamila Sarwar, Maidul Hossain , Pinak Chakrabarti(2017) Spectroscopic interaction study of human serum albumin and human hemoglobin with Mersilea quadrifolia leaves extract mediated silver nanoparticles having antibacterial and anticancer activity, Journal of Molecular Structure 1141:584e592
15. Bipransh Kumar Tiwary, Somit Dutta, Priyankar Dey, Mossaraf Hossain, **Anoop Kumar**, Sony Bihani, Ashis Kumar Nanda, Tapas Kumar Chaudhuri, Ranadhir Chakraborty, (2017) Radical Scavenging Activities of Lagerstroemia speciosa (L.) Pers. Petal Extracts and its hepato-protection in CCl4- intoxicated mice, BMC Complementary and Alternative Medicine,**17**:55

Career Development Training and Short Course/Workshop

(a) Training Course on "Application of Research Techniques in Reproductive Biomedicine" from 21st October to 1st November, 2013 at National Institute of Health and Family Welfare, Baba Gangnath Marg, Munirka, New Delhi-110067 on recommendation of **Honorable Vice Chancellor,** North Bengal University, Raja Rammohunpur, Darjeeling-734013.

(b) Orientation Programme (OP-116) conducted by **UGC-Academic Staff College, Himachal Pradesh University, Summer Hill, Shimla-15** held from **02-06-14 to 28-06-14** with grade **'A'** for overall performance.

(c) DST sponsored national workshop on " **Application on Mass Spectrometry for Proteomics" at AIRF, JNU, New Delhi from 6th Aug., 2014-8th Aug., 2014 at Advanced Instrumentation Research Facility, Jawaharlal Nehru University, New Delhi.**

(d) Short course training programme on : **Molecular Approaches for diagnosis of animal cancers and strategies for developing cancer vaccines** From 01 Nov., 2014 to 10 Nov., 2014, **at IVRI, Bareily** sponsored by **ICAR, New Delhi**

(e) Attended : Refresher course under the title of, "1st Refresher Course in Life Science and Biotechnology" from 20th July, 2015 to 14th Aug., 2015 at HDRC-J.N.U., New Delhi

(f)"2nd National workshop on NEXT Generation Sequencing in disease diagnosis and therapeutic target discovery", National Institute of Pathology, New Delhi during March 14-18, 2016

(g) Short course training programme on :**Recent Advances in** fish reproductive **biotechnology** for propagation of endangered speciesfrom 18th July, 2016 to 27th July, 2016 **Sponsored by I.C.A.R., New Delhi**

(h) Short Course Training Programme on:**- Molecular Immunology of Fish and Shelfish**from 15th March, 2017 to 24th March, 2017 **fully Sponsored by I.C.A.R., New Delhi**

(i) Attended RC:- "Multi-omic applications in medicinal plant research" **at** The University of Trans-Disciplinary Health Science & Technology, Bengalore, 11th to 23rd February, 2019, fully sponsored by Indian National Science Academy (INSA), National Academy of Science India (NASI), and Indian Academy of Science (IAS).

Specialized training/Project work:

- July 2001-October 2001: Four months project entitled **"Synthesis of Curcumin bioconjugate and their antibacterial testing"** at Nucleic Acids Research Laboratory,Department of Chemistry, University of Allahabad, Allahabad, under the guidance of **Prof (Mrs.)Krishna Misra,** Coordinator, Centre For Biotechnology, University of Allahabad, Allahabad.
- November 2000-January 2001: Two month summer training entiltled **"Amino acids selective unraveling for measurement of pseudo-contact shift and residual dipolar coupling"** under the supervision of **Prof. K. V. R. Chary,** Department of Chemical Science, **Tata Institute of Fundamental Research,** Mumbai.

Hobbies:

Gardening, Tracking, Reading, Movies watching, Meditation, Walking, Study on Human Behavior

Technical Expertise:

- **Molecular Biology:** Standard techniques such as Transformation, plasmid preparations (Miniprep, Maxiprep), Cesium Chloride gradient method, Genomic DNA preparation, Restriction digestion, GENE Clean DNA elution, Agarose Gel Electrophoresis, Sub-cloning of genes, SDS-PAGE, Native PAGE, Polymerase Chain Reaction, Silver-staining of Polyacrylamide gel, Radioactive labelling of DNA by Polynucleotide Kinase, Klenow filling and Hot PCR, Colony Hybridization, Dot Blot, Colony PCR, Colony prep, S1 nuclease assay, **ChIP assay.**

- **Mammalian Tissue culture:** Proficiency in **Mammalian cell culture** of adherent cell- lines (HepG2, HeLa,, KB, H1299, HEK 293 and MCF cell lines), their maintenance, preservation, sub culturing and harvesting, Media preparation, nuclear protein extract preparation from mammalian cells and Transfection for reporter gene assay (Luciferase assay system), transfection TFO oligoes and biotin oligoes for triplex study.

- **Techniques for studying DNA-Protein interaction:** Electrophoretic Mobility Shift Assay, Supershift assay, Molecular weight determination by UV cross-linking, Luciferase reporter gene assay, Affinity purification of DNA binding proteins using Biotin-Streptavidin magnetic beads system and acrydite technique.

- **Biochemical techniques:** DNA and Protein estimation using colorimetry and UV-spectrophotometry, Thin layer Chromatography, Paper Chromatography, Column Chromatography, Protein purification processes like Affinity (His and GST) chromatography, 2D-gel Electrophoresis,

- **Immunology:** ELISA, Western blot, Immunofluorescence, Immunoprecipitation.

- **Radioactivity usage:** Autoradiography, Liquid scintillation counting, Working experience in handling of isotopes: P^{32}.

- **Computer applications:** Working Knowledge of various computer preograms: MS windows and MS-DOS, Microsoft Office, Microsoft Excel, Paint, Adobe photoshop, Powerpoint.

- **Known Techniques:** Confocal {LSM (Laser Scanning Microscopy)}, Fluorescence Microscopy, FACS, AFM (Atomic Force Microscopy), Scanning Electron Microscopy.

Ph.D. work summery

I have completed my ph.d. in Biotechnology from the School of Biotechnology, Jawaharlal Nehru University, New Delhi, India, under the supervision of Prof. Uttam K. Pati. The title of my thesis was "**Triplex forming potential of polymorphic PNR sequences in the upstream region of apo(a) gene and identification of PNR binding proteins"**, in which I have studied different forms of nucleic acids structures (Triplex DNA) and their effects on gene expression with transcription factors. Apolipoprotein(a) is well known apo family's protein highly responsible for the coronary artery disease. It has similarity with plasminogen. Apo(a) synthesis takes place in liver and then it comes to blood. At the time of atherosclerosis its level in the blood increases which is one of the region of blockage of artery. Earlier it had been studied in our laboratory that the gene which actually controlled by 1.4kb upstream region have three regulating region **PNR(Pentanucleotide Repeats), PRE(Positive Regulatory Region) and NRE(Negative Regulatory Region)**. The two negative regions (PNR and NRE) sandwich positive region (PRE) and repress and activate gene expression respectively. As the title of my thesis indicate I have worked on PNR region which has **pentanucleotide repeats (TTTTA)n** and act as repressor in apo(a) promoter. On the basis of published paper I came to know that these PNR repeats numbers play a major role in coronary artery disease for instance people having 5-8 repeats will suffer from CAD and those people have 9-12 repeats are less prone towards disease. Homologous and heterologous repeats (8/8, 9/9, 10/10, 8/9, 9/10, and 8/10) are present in human beings and I have also studied it in KB, HeLa, H1299, $HepG_2$, HEK 293 and MCF7 mammalian cell lines. Because it has polypurine-polypyrimidine repeats so I tried to work on its structure and found that these regions have potential to form triple helical DNA structure and regulate apo(a) gene. To prove this I have used lots of molecular biology techniques. Mostly I have worked on nucleic acid and chromatin to find out transcription factors and to prove triplex structure at chromatin level. I have also found that the polymorphic pentanucleotide region at upstream region of apo(a) promoter have structural differences because of PNR numbers such as PNR-8 could not formed triple helical DNA structure like PNR-9 and PNR-10. That is why some transcription factor could not recognize that region and does not bind on that to control apo(a) regulation. During my research work I have used **Triplex Forming Oligonucleotides (TFO)** to target the gene which is

responsible for intramolecular triplex formation. I have also used **Atomic Force Microscopy** to saw intramolecular triplex formation in the plasmid DNA containing polymorphic pentanucleotide (AAAAT)n region of apo(a) gene. I have worked with **Biotin-TFO** to confirmed **chromosomal triplex formation in chromatin**. I have identified two novel DNA binding proteins which overlap the region which involved in triplex formation and regulate apo(a) gene expression. By the help of gene-regulation search engine, I have also found out a zinc finger protein whose binding is overlap with triplex forming sequence. Basically it is a triplex binding protein which I proved first time by our experiment. The binding of this protein was confirmed by recombinant protein through **gel mobility shift assay** and **ChIP (Chromatin Immunoprecipitation)** assay. Its promoter activity has been checked by luciferase promoter reporter assay. I have also silence the zinc finger protein by **shRNA** tool and made stable Evi-1 gene silenced cell lines and done promoter reporter assay in these cell lines.

Master of Science work

Summer training program

I have worked on **CaBP (Calcium Binding Protein)** of ***Entamoeba histolytica*** during my master of science with title "**Amino acid selective "unlabeling" for measurement of pseudo-contact shifts and dipolar couplings**" at **Tata Institute of Fundamental Research, Mumbai, INDIA** under the supervision of **Prof. K.V.R. Chary**. In this program I have studied the development of new multidimensional NMR techniques, facilitated in obtaining high precision protein structures in solution. However, in the case of large size proteins (Mr> 20kDa), poor resolution due to severe spectral overlap complicate their analysis. In order to address this problem, a novel methodology was proposed, called amino acid selective "unlabeling". In this approach, specific amino acid residues in a protein are selectively "unlabled" while uniformly or fractionally ^{13}C or/and ^{15}N labeling the rest. The cross peaks belonging to the unlabeled amino acid residues are thus absent in various NMR spectra recorded with such a protein sample, leading to significant spectral simplification. Such methodology has been demonstrated obtain residual dipolar coupling constants and pseudo contact shifts in a 15 kDa lanthanides substituted calcium binding protein from Entamoeba histolytica. I overexpressed CaBP

recombinant protein in E.Coli BL21(DE3) strain using ammonium chloride (N15), replacing N14 to N15 at amino acid level and unlabled protein was studied by 2D-NMR.

Dissertation work during M.Sc.

I have completed my master of science dissertation work on title "**Synthesis of curcumin bioconjugates and their antibacterial testing**" under the supervision of **Prof. (Mrs) Krishan Misra** at **Nucleic Acid Research Laboratory, Department of Chemistry, University of Allahabad , Allahabad- INDIA**. Curcumin, the most active ingredient of turmeric, contain anti-cancer, anti-inflammatory, anti-oxidant, anti-HIV and wound healing activity. Drawback of curcumin is its poor cellular uptake when administered orally. Curcumin bioconjugates were synthesized without disturbing its medicinal activity and making it toxic. In this approach, those amino acids were selected which are familiar to micro-organism cell wall and will not make any complication in the curcumin to reduce its activity. Enhancing the specificity of therapeutic drugs and thereby improving their site specific delivery with biodegradable bonds was primary goal of this project. I have made bioconjugates of cucummin and tested it on pathogenic bacteria and mammalian cell lines. This work has been published in cancer letter journal.

(Anoop Kumar) Date:-22-05-2022